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A SOCIAL SCIENCES

AA	PHILOSOPHY AND RELIGION
AB	HISTORY
AC	ARCHAEOLOGY, ANTHROPOLOGY, ETHNOLOGY
AD	POLITICAL SCIENCES
AE	MANAGEMENT, ADMINISTRATION AND CLERICAL WORK
AF	DOCUMENTATION, LIBRARIANSHIP, WORK WITH INFORMATION
AG	LEGAL SCIENCES
AH	ECONOMICS
AI	LINGUISTICS
AJ	LITERATURE, MASS MEDIA, AUDIO-VISUAL ACTIVITIES
AK	SPORT AND LEISURE TIME ACTIVITIES
AL	ART, ARCHITECTURE, CULTURAL HERITAGE
AM	PEDAGOGY AND EDUCATION
AN	PSYCHOLOGY
AO	SOCIOLOGY, DEMOGRAPHY
AP	MUNICIPAL, REGIONAL AND TRANSPORTATION PLANNING
AQ	SAFETY AND HEALTH PROTECTION, SAFETY IN OPERATING MACHINERY

THE STRUGGLE FOR HIGHER JOB POSITIONS AS AN ETHICAL PROBLEM

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Abstract: Competition for working positions at the workplace constitutes one of the real problems frequently encountered in business and management ethics. Despite its frequent occurrence at the workplace, as literature research shows, theoretical reflection on the issue within applied ethics is relatively rare. The present paper aims to provide a scholarly reflection on the unfair competition for positions, which is not in compliance with the ethical rules of competition. Furthermore, significance will also be placed on providing a definition of unethical job competition, identifying the features of this pattern of behavior, as well as describing the impact of this undesirable phenomenon. The present paper contributes to the underlying reflection on the issue from the point of view of applied ethics as applied in Economics. The main task of the study is to delineate the various features of unfair competition for higher work positions and the terminology related to this issue, possible ethical theoretical apologetics, and to describe the negative consequences of such conduct and practices.

Keywords: competition for work positions, personnel management, managerial ethics, workplace relations

1 Introduction (Times New Roman, Bold, Font 8)

"Despite the best efforts of corporate compliance officers, boards of governance, auditors, and regulators, corporate misconduct continues to plague our markets" (Hess and Broughton 2014: 541). Honest, fair, ethical competition to fill leadership positions is a *conditio sine qua non* for maintaining a favourable ethical climate in any enterprise. Violation of this principle in any sense (nepotism, corruption, etc.) creates a potential basis for the emergence of a bad organizational culture in an organization. An ethical audit conducted in time after such a distorted outcome of the selection process is unlikely to register significant positive values in the organization. A successful attempt to secure any leadership position in an unethical manner means, first and foremost, a shattering of trust in the selection mechanism in a particular organization. The negative consequences of a successful candidate using the unethical mechanisms mentioned above to influence selection are numerous. Ultimately, it not only means a deterioration of the ethical climate and a weakening of the functions of the organizational culture in the company, but it can also often bring about a real decline in the performance of the organization or a sub-organization. This is a problem at the intersection of managerial ethics, business ethics, business management and personnel management, which also needs attention at the level of theoretical reflection. Insofar as the unethical filling of leadership positions is associated with corruption, it is also true that widespread corruption in the public sector also affects ethical behaviour in firms (Oliveira et al. 2019). In the V4 area, according to research conducted by Zvaríková et al., the best situation in terms of real implementation of business ethics with results in Hungary and the worst in the Czech Republic (Zvaríková et al. 2023).

2 An attempt at a definition and description of the unethical struggle for leadership positions

The first aim of the present paper is to define the unethical struggle for leadership positions. A regular struggle for a specific job position means that it is a way of struggle without lateral manoeuvres, ensuring the condition of transparency and selection on the grounds of real competencies and results achieved by the candidate. On the contrary, an unethical struggle for a particular position, for a post, means a violation of transparency and principles based on competence, education and the results obtained by the candidate. If we want to define unethical competition for senior posts, we must characterise it as competition with the decisive influence of factors other than qualitative factors (based on merit, results, competence and education) (Šeben Zařková 2015). These factors are based on other factors, which can be defined demonstratively as follows:

personal relationships, violence or the threat of violence (in whatever form), the offer of an undue advantage (cash, a gift in kind, an advantage in the workplace, a *quid pro quo*), discrediting the opposing candidates, and others. In principle, an honest competition for a job differs from an unethical one by using the above-mentioned unlawful means of struggle. "Struggling through lying, intimidation, and disrespect is not ethical. A struggle is also unethical when it is motivated by unethical reasons (such as revenge), aimed toward unethical goals, or when the struggle is merely an end in itself" (Kaptein 2017: 355). We can distinguish two basic situations of struggle for jobs: a) efforts to obtain a new, usually hierarchically higher job position, and b) efforts to keep the current job position in the upcoming periodic selection procedure. The situation is even more complicated if it occurs under conditions of job insecurity (Bacile and Ferreyra 2012).

In many cases, latent or overt violence is tied to a particular selection procedure, or threats are themselves a form of violence. The goal is to obtain benefits in terms of getting a job and keeping a post. The perpetrator of the violence in question is the person who is one of the candidates for the position or someone who is servilely devoted to the candidate. If this person is willing to go to the stage of violence, it indicates a high preference for the incriminated job in their value ranking. Engaging in any kind of violence in a struggle for a job involves a high degree of unethical struggle.

While the Anglo-Saxon references use the terms Organisational, political tactics and political behaviour, the term chairing also occurs, signifying the same in Czechia and Slovakia. In the Anglo-Saxon research literature, organisational, political tactics and political behaviours refer to a conscious effort to gain personal benefits (status, power, prestige, money, etc.) (Kapoutsis et al. 2012); (Tripathi and Tripathi 2023). The terms may often have the same basis, but their semantic scope and function may differ (Kačmarová et al. 2016). Chairing, however, is a label for a very different concept in the Anglo-Saxon reference literature. It signifies leadership in the sense of presiding over something or managing something. It would be desirable to unify the terminology and use it uniformly in English in applied ethics and science in general.

Promotion to a senior position is a common practice in the labour field. Clear and transparent rules for promotion to senior positions reflect a developed and progressive organizational culture. The promotion policy should provide a transparent way of tracking promotion procedures. The pathways to leadership positions involve a variety of mechanisms. In any case, they should not only be transparent but also conducted under the elementary principles of managerial and business ethics. Each organization has an organizational culture of a different quality. A sound organizational culture automatically makes it possible to compete freely for jobs on the grounds of ethically sound, transparent rules and in close compliance with them. Control mechanisms ensuring transparency and compliance with ethics in the promotion mechanisms are the *conditio sine qua non* of a healthy organizational culture. Indeed, it is the failure of organizational culture that causes the undesirable phenomena of unethical behaviour in job promotion and advancement mechanisms. Namely, it is the consideration of factors that mean nothing in terms of competence, merit, and education yet can make a decisive difference in the outcome of a selection among several candidates.

3 Searching for the causes of the unethical struggle for leadership positions

To answer the question of what causes unethical competition for jobs, the answers must be sought in candidates who use factors other than professional and occupational factors to influence the outcome. The main cause can be identified, first and foremost, as an over-hyped, over-emphasised interest in obtaining a job by

any means. This egoistic form of careerism is very far from Aristotle's centre (μεσότης). A candidate running for a position in this way grasps primarily selected aspects of the leadership position as their major priority. These include social status, a management premium, decision-making competence, or other benefits. The aforementioned aspects of the position are of such importance to the candidate that the desire to obtain them is, in fact, hierarchically superior to ethical values and ethical invariants. Sacrifice (free time, energy) and responsibility are, to a greater extent, inextricably bound up with the exercise of leadership in the workplace. Nevertheless, the desire to perform a position is only evaluated negatively if it is associated with means that influence the promotion outcome in a way other than related to competence, education, and job performance.

The answer to the cause of unethical struggle in the sense discussed lies primarily in the personalities of the particular candidates whose struggles exhibit the characteristics of unethical practice. Various typologies of personalities have been identified. An interesting definition of a personality who consciously and deliberately uses unethical means of action was proposed by Krupa and Masarik. They consider a person with such traits to be a pleonectic personality. They define it as follows: "A pleonectic personality is a person who, at the time of their actions, convinces themselves and others that a dishonest means of achieving an advantage is common and acceptable, and often the only way to achieve success" (Krupa and Masarik 2009: 86). Such a personality does not help others; they consider people with competence, results and knowledge as potentially hostile persons. If such a person possesses multiple competencies, they naturally do everything possible to occupy high positions, especially if these bring cumulative benefits. The worst circumstance is that a pleonectic personality will violate ethical rules at any time, as long as, by doing so, they potentially gain a competitive advantage in the competitive selection process for a senior position.

Excluding the condition of latent mental disorder, narcissism can be indicated. It was described by Sigmund Freud in 1914. Freud defines narcissism as the transformation of the investment of the libido towards the self. Freud divides narcissism into primary and secondary. Primary narcissism is a condition with the libido centred on the self. Secondary narcissism, on the other hand, is an excessive focus on one's benefit, on making one stand out at any cost. Such a person has an unnaturally intense craving for the attention of others; they do not have the capacity to care for other people to the extent that a person without the aforementioned pathological condition does. Considering the issue under discussion, people with secondary narcissism are potentially susceptible to workplace behaviours, exhibiting signs of unethical struggle for higher job positions since primary narcissism is referred to as childhood narcissism. Such a personality poses an increased risk of manifesting itself in the abovementioned sense.

In this sense, we consider the value orientation of the personality to be a key indicator of whether they adopt the reported undesirable behavioural patterns. Fundamental human values, regarded as basal, were introduced independently by the psychologist Abraham Maslow and the philosopher Sün-c. Both deny innate qualities and innate ideas, such as Locke. Both Sün-c and Maslow postulated the idea that innate desires exist, such as the desire to be safe, the fear of death, the desire to have sex, and the desire to eat and drink. These innate desires can be regarded as fundamental human needs.

Dupkala argues that there is no value in the world that every organised social group can agree on (Dupkala 2018). Certain common boundaries of behavioural patterns necessary for coexistence need to be respected within the workplace. If there is at least a framework alignment of personal values with certain values held in the workplace, there are no major ethical problems in terms of managerial and business ethics. "The hierarchy of values is considered the most reliable prognostic sign that expresses whether a person can behave in accordance with his environment" (Králík 2023: 249). Ethical value orientation is

already formed during preparation for work in the form of education (Michvockíková et al. 2023).

Egoistic value orientation tends to be a source of various conflicts, but also of unethical behaviour, if it permeates and dominates behaviour patterns. "The literature on personality traits and defence mechanism suggests individual differences in two self-favouring tendencies, which we label "egoistic bias" and "moralistic bias" (Paulhus and John 1998: 1025). This creates two personality constellations, labelled Alpha and Gamma. While Alpha embodies self-deception, artificially inflating personal competence, Gamma is, in turn, associated with another self-deception that denies social deviant impulses and claims exaggerated honours. Under the influence of the aforementioned self-delusions, the personality undergoes an extremely inflated self-assessment, unrealistically evaluating qualities such as intellectual competence, creativity, personal stability, boldness, etc. If given the opportunity, such a dedicated person will likely aspire to leadership positions in the workplace. Unless these can be achieved by ethically relevant means, there is a reasonable danger of choosing ethically contaminated practices. Such a danger exists both in seeking to occupy a particular leadership position and in seeking to retain it. Other adverse social consequences are associated with this (damage to image, deterioration in the quality of the organisational culture, disruption of workplace relations, etc.). The radicalization of the language of selected political parties does not contribute to the increase of altruistic orientation - compare (Kumorová 2022).

4 Identification of the roots of egoistic value orientation in the history of ethics

The egoistic value orientation is reflected in the history of ethics. Plato considered such an orientation undesirable since his orientation was national and directed towards positive virtues. These were also manifested in the state as a metaphor for somatic representation (Hasanifar and Alavipour 2021). Older and younger sophistry did not take a particular stance on egoism. However, the ambivalent approach of the relativists also allowed for the egoistic use of what the sophists called the stronger logos (Adrados 1984). In the traditional interpretation, Thrasymachos recognized the right of the stronger as the definition of justice - if Plato is to be trusted - yet other existing interpretations challenge this (Hourani 1962). Aristotle, as is well known, recognized the primacy of the whole over the part in both ethics and ontology. Individualism resonates especially in some Hellenistic schools. Epicurus, outspoken in his focus on pleasure as the goal of bliss, did appeal to the exploitation of what the possibilities of life bring, but certainly not in a hedonistic sense. Still, he adored an egoistic value orientation less. The Cyrenaic school may be regarded as the ideological source of ethical individualism and egoism. The fundamental value is happiness. This hedonistic axiological position perceives happiness as a value so significant that it should be sought and prioritized. A prominent school representative, Theodoros, did not even recommend the interruption of pleasure should it be to help a friend. In the ancient philosophical tradition, this is the only school oriented principally towards hedonism. The earliest accounts identify its representative, Aristippus, as a follower of Socrates (Suvák 2022). Any speculations about the hedonistic orientation of the ancient Indian Lokayata movement are unfounded, primarily because of the almost complete absence of primary texts that can be plausibly attributed to the school's representatives. "All the modern academicians invariably looked at it from the point of view of materialism and as a fitting response to Brahminism" (Kanchi 2016: 404). More recent research reveals a rather prominent role for meditation and spirituality in this school, challenging its previous materialist image. There is little to conclude about the ethics of Lokayata; future results from historians of Indian philosophy must be awaited.

Neither late antiquity nor the period of medieval philosophy produced even hints of an ideological foundation for ethical egoism. Nor is the apparent promotion of individualism in Erasmus of Rotterdam's Praise of Folly a real philosophical

endorsement of imbued egoism in its pure form. To the ethicists and philosophers of early Christian philosophy, scholastic philosophy, and Renaissance philosophy, the egoistic value orientation was very distant.

Mill's utilitarianism differs from Bentham's commitment to the importance of a religious sensibility in the moral agent (Heydt 2006). The change comes only with the philosophy introduced by Bernard Mandeville, who viewed utility as an economic and social benefit. He regarded egoism and its goals as the primary driver of action and decision-making. Mandeville's *Fable of the Bees* is well-known. At this point, the author reminds us "that capitalism created wealth while necessarily relying on vicious impulses" (Bragues 2005: 179). For Mandeville, man is ruled precisely by the passions. Although the said philosopher protracted the importance of self-love, he spoke about the possible connection of egoism with the interests of society. He drew attention to the possibility of the connection of the general interest with the interest of the individual, which he considered to be the potentiality of a functional morality. The field of law can help morality to make sense of rules. In the case of perfect law, he does not foresee major problems with compliance with legal directives. Claude Adrien Helvetius held similar but somewhat more moderate views. The opposite of some egoistic goals is recognized by Kierkegaard, whose ethics is based on the love of neighbour and love of God (Martín, Rojas and Rabbit 2021). Seemingly, John Stuart Mill's voice could also be heard as a promoter of egoism. He considers a person's actions right and wrong directly proportional to his promotion of happiness and his prevention of paths to it. Utility, which utilitarians recognize as a guiding ethical principle, cannot be equated with egoism since it is a utility that is not reducible to what one individual finds useful. Mill's utilitarianism differs from Bentham's in his commitment to the importance of a religious sensibility in the moral agent (Heydt 2006).

In this context, it is worth noting the ethics of F. W. Nietzsche since it involves a return to the original ancient values reflected in the *Iliad* and *Odyssey*. A significant component of his ethics is the will to power. However, it does not refer to complete egoism in the strict sense. "Nietzsche is asking whether morality in its present state is good for human beings, where what counts as good has to do with the kind of creatures we are, and so what it takes for us to flourish" (Harris 2015: 327). The values of the Homeric epics included strength, youth, wisdom, self-sufficiency, and nobility. The beautiful young Achilles in full armour, more godlike than human, is the bearer of the ideal. To some extent, the ancient hero acts as he pleases; ultimately, he, too, is obliged to keep his duties. However, he holds them only towards his peers, not towards people. The model of Mother Teresa's behaviour would have been incomprehensibly alien to Nietzsche. In an egoistic way, she applies the morality of the masters to the detriment of the weak. "Nietzsche is commonly thought as a perfectionistic consequentialist, as an ethicist who thinks we should promote the good, but who has a distinctive and controversial view of what that good is" (Slote 1998: 23). Nietzsche had a justification for egoism if one's behaviour in this way led to an enhancement of the creative component of the human subject. He considered the morality of slaves, or appeals to Christian values, to be harmful. In contrast, the morality of masters aims to enforce a will to live where the strong triumph over the weak.

The ethics of classical pragmatism is also related to the issue under study. Here the rule of action is postulated rather vaguely, what is right is what is currently considered useful, what brings some benefit. Pragmatism thus has no clearly defined values. In essence, the pragmatist creates their values ad hoc, according to what is useful to them at the moment. The pragmatist theory of truth carries its vagueness into axiology and thus into ethics (White 2010). Thus, the subject makes a choice of values. The value may not be the subject themselves and their experience of themselves, but it is the subject themselves who creates the values for themselves. This is not directly about egoism, as the subject can choose values other than self-centered ones. The neo-pragmatist Rorty looks at values antiplatonistically. "Many

philosophers have worried about Rorty's giving up on absolute values, and the same concern arises in business ethics" (Pouryousefi and Freeman 2021: 576). On the other hand, the positive role of American pragmatism in shaping business ethics should be highlighted, as a key step in its development took place in the milieu of American pragmatism (Heinrichs 2018). Modern non-utilitarian consequentialism, ethics of social consequences can be linked in terms of the analysis of the subject of morality through the optics of C. G. Jung's fundamental psychological forms (Petrufová Joppová 2017). Kalajtzidis clarified that ethics of social consequences might be considered as a hybrid ethical theory (Kalajtzidis 2019).

If we are to trust the conventional interpretations of the Cyrenaic school, its representatives were relatively strong advocates of the principles of egoism in antiquity. The ethical values of egoism were to some extent supported by Mandeville, yet he associated them with the union of the interests of the individual and society. Even the undeniable egoistic charge in Nietzsche can be weakened by the duty of the powerful to their fellow individuals. Pragmatism contains only the potentiality of egoistic understanding. In each of the schools of thought, philosophies that contain a certain rational core compatible with the egoistic viewpoint in the form of the network of Quine's statements, there is a danger that the educated egoist might use them to defend their actions, indifferent either to other individuals or to their conscience.

5 Signs of the unethical struggle for leadership positions

Unethical struggle for higher positions has its characteristics, allowing for identification. This phenomenon is based on using unauthorised, unethical means of influence in the struggle for a senior position. The negative is not the effort to gain or retain a senior position but how it is fought for. The use of illicit means constitutes a fundamental difference from standard competition. We can present the most commonly used illicit means in the above context.

Fraud in its various forms is a common illicit means occurring in the acquisition of various leadership positions. Fraud in getting a certain lucrative job position can be carried out differently. The most commonly used is the provision of false information. Simply, a potential candidate for a position operates with information not based on the truth. In some cases, they may use forged official documents. More often, it is a matter of providing information that is difficult to confirm or deny. A candidate for a position fabricates attributes not attributed to them, such as attendance at events and scientific conferences, artificially exaggerating their years of experience. In addition to outright fabrication, the candidate may falsely interpret otherwise true facts concerning the job description, the manner of participation in the stated events, etc. Sometimes, it may be a modification of the results obtained, deliberately and artificially improved. Prudence is an appropriate virtue in this context (Nemec and Blaščíková 2021). Prudence is more appropriate here than forgiveness (Sucharek 2017).

Attacking competitors is another manifestation of grabbing leadership positions in an unethical manner. Attacking competitors can be covert or overt. In terms of overt attacks, these can take place both in and outside the workplace. If the candidate is not outsourced, it is mobbing or bossing and staffing. Different circumstances arise when the attempt is made to obtain a management position and when the effort is made to retain it. A simple assault in the form of a display of brute force is rarely a form of a struggle for a job, as it is most likely to be turned against the person of the aggressor. Therefore, in this context, mobbing is more likely to be sophisticated. The point of this sophistication is to mask the perpetrator of mobbing. Covert mobbing is more difficult to detect. It takes the form of vicarious mobbing, ideally without witnesses, over the telephone or on social networks. Even if there is the eventuality of a physical attack, it is usually carried out with the help of a hired person. These are various forms of influence on a particular person to be exhausted, tired, or disgusted.

The signs of an unethical struggle for a leadership position include direct influence on decision-makers. Influencing the direct key decision-makers on the outcome of the process is a frequent and potentially the most effective sign of unethical competition for positions. In a more primitive form, it involves attacks through anonymous letters, emails, and phone calls, but this is hardly effective. Direct, targeted slander is more effective since it can damage the candidate's credibility, especially if carried out indirectly, seemingly without any links to the person who ordered it. It is a targeted campaign against specific decision-makers about the outcome of the process, whether in the company's organisational unit or its management circle. A well-targeted anti-campaign against a candidate tends to be directed at the decision-makers and is conducted covertly through third parties so the victim does not find out about it. If this feature of unethical competition for positions is met, it generally has the highest chance of being effective compared to other features mentioned.

Another sign is an attempt to obtain information that would give the potential candidate an undue competitive advantage. It can be obtained by disclosure from a third party, hacking, or physical theft of the contents of documents (by photographing them, scanning them, etc.). Subtle information can sometimes be the key to success; in this case, it is obtained unethically. Influencing the members of the decision-making committee does not have to be conducted by the candidate only through denunciation of the opposing candidate. The candidate may also use bribery to corrupt the committee members by utilizing undue advantages and counter-benefits or in return for material or financial remuneration. Such serious ethical misconduct, if proven, may be grounds for a final conviction on the merits of criminal offences in most countries.

Sometimes, a particular form of the signs of unethical job competition is specifically linked to bossing. It refers to the situation in which a manager intends to defend their position in a new selection procedure. Bossing can be used as an intimidation manoeuvre by the manager, but it is a risky tactic that can easily backfire on the actor. Rather, we encounter the practice that the tendency towards bossing is stronger, especially in the period after taking or defending the position and the goal in such a case tends to be the elimination of possible competitors and possibly disagreeable workers (Birknerová, Zbihlejšová and Droppa 2021).

In applied ethics, the term whistleblowing has mostly positive connotations. However, it also refers to the monitoring and carrying of information to inform a manager or a candidate for a position about individual employees' opinions and current settings. Likewise, secretly obtaining information from third parties gives an undue advantage that a candidate for a position can take advantage of, especially if they currently hold a senior management position. With the help of dedicated co-workers, an intelligent executive can use the information obtained as an unjustified competitive advantage, allowing them to plan and anticipate in the first place.

Attempts have been made to list some behaviours exhibiting signs of an unethical way of competing for a leadership position. Means such as deception, illicit acquisition of information, manipulative interference in the decision-making process, corrupt patterns of behaviour, etc., are certainly not among the repertoire of ethically acceptable and benign instruments for obtaining a senior position.

6 Possibilities of impact of the described behavioral models on the organization

"The business environment has been very turbulent in recent years and businesses need to be able to respond flexibly to different changes and situations in this environment" (Mišún, Paprskárová and Mišúnová Hudáková 2019: 210). The impact of the described behavioural patterns on the organization can be highly negative. If such phenomena occur in the workplace, they drain the necessary energy and time to deal with work tasks, etc.

"Work ethics has the highest implications for improving employee performance" (Hasibuan and Azmy 2022: 56). Forces that can be used more economically from the organization's viewpoint are allocated unnecessarily. Entropy in the organization is increased, which can be displaced into the environment when the elements that cause it are identified in a standard situation (Lysá et al. 2019). The second consequence is a possible deterioration of the corporate culture. The third negative consequence is mainly the deterioration of workplace relationships. If the described phenomena occur in the organization, mobbing or bossing associated with the situation can disintegrate workers, disgust them, and weaken their loyalty to the organization. Another negative consequence can be a deterioration of the corporate image. Negative references have a bad impact on the company's external PR. The very negative consequence is the eventual victory of the candidate who uses unethical means of competition. Potentially, there are other series of unethical behaviours such as bribery, bossing, unauthorized use of company finances for personal gain, rewarding employees for work other than meritorious, losing out on tenders, etc. Corrupt behaviour can lead to profitable black market business (Eidam 1996). The worst possibility is a person with signs of recurrence of unethical behaviour and without the necessary competencies for a managerial position. In a knowledge economy, skilled workers play an important role in innovation and economic growth (Castro-Silva and Lima 2022), i.e., the mentioned possibility negatively affects the influential economic factor. Kaizen technology can be applied in organizations, but people with toxic behavior are an obstacle to progress (Trubavina et al. 2021).

7 A few recommendations for practice

Finally, several recommendations may be formulated and applied in the practice. Firstly, it is advisable to implement the topic of unethical struggle for positions in corporate ethics education as a problem that is not insignificantly frequent in organizations. Secondly, it is necessary to implement the topic in both classical and modern tools for applying business ethics to organizations. Thirdly, it is also recommended to work on prophylaxis of the pertracted phenomenon in the sense of effective controls of superior bodies, administrative bodies, and relevant commissions, which could reveal the mentioned ethically incorrect phenomenon and combat it. The measures taken may also lead to the disqualification of the perpetrator of the undesirable behaviour from the competition. Eventually, the issue could be shifted by appropriate legislative amendments, especially if they are favourable to the application of effective sanctions. Last but not least, it is also necessary to intensify awareness of the issue under consideration.

8 Conclusion

The present paper aims to define, describe, and identify the basic features of unethical competition for senior positions and recommend certain countermeasures for its elimination. Unethical struggle for senior positions differs from the correct one simply by the use of means. We have also endeavoured to clarify the issue terminologically in terms of using terms in the English language. The Anglo-Saxon literature prefers the terms organizational political tactics, political behaviour in the issue under discussion. The causes of this kind of behaviour can be observed in an egoistically oriented personality, while it may also be secondary narcissism, as described by S. Freud. The basic issue lies in the inappropriate value emphasis given by a particular person to a higher job position. In order to obtain it, they will also choose an unethical course of action. We have endeavoured to identify the ideological sources of egoism and individualism in the history of ethics, which has been partly successful in the Cyrenaic school and B. Mandeville. Some features can also be observed in the work of other ethicists. We believe that strong control mechanisms, effective sanctions in case of violation of ethical rules of the selection process, and exclusion of the actor of unethical behaviour from the competition are ways to prevent unethical competition for work positions.

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Primary Paper Section: A**Secondary Paper Section: AA**

INNOVATIVE PROCESSES IN TOURISM OF UKRAINE

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Abstract: The purpose of the article is to determine the features of innovation processes in the tourism industry of Ukraine. To conduct an objective and thorough study, the following methods were used: abstract and logical; analysis and synthesis; system analysis; method of analogies; method of expert evaluations. The content of innovations and innovative activity is characterised, the main types of innovative technologies in the activities of tourism enterprises are considered. The main factors influencing the introduction of innovative technologies are highlighted, namely: the adverse impact of macroeconomic shocks, increased flow of financial risks, lack of own financial resources, low innovation activity in the service sector in Ukraine. It is determined that strategic management of innovations is important for service enterprises, which improves both entrepreneurial and professional economic management.

Keywords: Innovation, innovation process, innovative activity, innovative technologies, tourism, tourist enterprise.

1 Introduction

Tourism has great economic and social importance for the economy of many countries and is one of the fastest growing sectors. Due to high competition in the industry and economic and political instability in many regions, new challenges arise for the transformation of tourism towards innovative development (Bekjanov & Matyusupov, 2021).

If we look at the current practice of the global development of international tourism, the growth of competition in the tourism market and a number of other factors require the introduction of tourism innovations. In addition, modern changes in demographic, economic, social conditions, as well as changes in human psychology are becoming economic drivers, opening the way for the wide application of innovations in the tourism industry (Alimova et al., 2020).

The innovation process in tourism is developing in response to changes not only in the tourism services market, but also in other spheres of society. Such changes include changes in the needs of potential consumers of tourism products, new achievements of scientific and technological progress, including new technologies and methods, expansion of the information based on tourism resources, competition between tourism enterprises, hotel companies, museums and other entities interested in attracting and servicing tourists and sightseers.

Tourism business experts identify several main categorical characteristics of innovations in tourism at this stage: source of ideas (demand of potential tourists, new scientific and technical discoveries); form of innovation (changes in tourism products, tourism services, hospitality infrastructure); scale of distribution (state, region, country, continent, global system); capital intensity (large, medium, small) (Chueva et al., 2021).

The tourism sector is currently undergoing significant changes due to the shift towards a more experience-based product and the rapid growth of the tourism market. This shift places greater demands on travel companies to innovate. The increasingly short life expectancy of travel products requires companies to increasingly introduce new and better products. The ability of companies to change, develop new products and adapt to changes in the market is crucial for business and industry performance.

The active use of modern innovative technologies in the activities of tourism enterprises is a prerequisite for their successful operation, as the accuracy, reliability, efficiency and high speed of information processing and transmission determine the effectiveness of management decisions in this area.

The use of innovative technologies allows businessmen and marketers to explore new market opportunities for their tourism services by identifying and studying various market segments (geographic, demographic, professional, organisational, behavioural, etc.). Tracking relevant information can be used to predict future consumer demand and identify new trends in the behaviour of existing and potential customers. The use of GIS opens up broad prospects for substantiating and designing new tourist routes and recreational areas, publishing thematic tourist maps and creating web atlases, etc. The use of innovative technologies has created a unified tourist information space, making real information promptly available to all players in the tourism market.

2 Literature review

In their article, the authors Amanova Nodirabegim Furkativna and Amanova Farangiz Furkativna describe the main directions of innovation in the tourism sector, as well as the factors that influence the development of innovation in tourism. According to the authors, the factors that determine the peculiarities of innovation in the tourism sector include: specific attributes of tourism products, producers and consumers of tourism services (Amanova & Amanova, 2021).

The role of innovation in the development of tourism and the fact that the tourism business depends on modern scientific developments and technological solutions, and the tourism industry is the initiator of the innovation process, search and development of new markets, are discussed in articles by such authors as R. K. Ergashev and Z. Yabborova (Ergashev & Yabborova, 2021).

Articles by authors such as Tomi Andrianto, Mehmet Ali Koseoglu, and Brian King review existing concepts and propose business model innovation process (BMIP) applicable to travel companies (Andrianto et al., 2022).

The article by S. Divisekera and V. C. Nguyen analyses the determinants of three types of innovation outcomes that are product, process and organisational which were generated by Australian tourism firms. The study examines how collaboration, human capital, information technology, financing, firm and market characteristics influence innovation outcomes (Divisekera & Nguyen, 2018).

In a joint publication, the authors M. T. Alimova, S. Y. Abdusaidova, and I. I. Tuichiev present the directions of innovative development in the tourism sector through the use of information technology in the industry (Alimova et al., 2020).

According to 57 interviews with tourism SME entrepreneurs in Spain and the UK, the article by A. M. Williams, I. Rodríguez Sanchez and V. Škokić identify how risk and uncertainty are understood as changes during the innovation process in key areas such as technology, finance, marketing and organisation. They also explore how tourism entrepreneurs respond to risk and uncertainty through a range of strategies, including knowledge and networking (Williams et al., 2021).

Systematic literature reviews can be found in publications by authors such as Birgit Pikkemaat, Mike Peters and Bernhard Fabian Bichler, which provide an up-to-date overview of tourism innovation research and an agenda for future research on the relationship between small and micro enterprises and innovation, eco-innovation and the interaction between governance and

innovation (Pikkemaat et al., 2019). In this article (Santos et al., 2021), progress towards sustainability and innovation in tourism is analysed through a systematic literature review that summarises the last five years of research focused purely on innovation and its application in tourism. This research includes a range of theories, practices, methods and outcomes at different levels, stages and drivers, as well as the pursuit of innovation and sustainability in many tourism contexts.

Innovation should be considered as part of a tourism development strategy, and ICTs play an important role in this regard. It is advisable to support effective tools to increase innovation in tourism. These innovative efforts at the national level can lead to increased tourism spending, which is economically beneficial (Gavurová et al., 2021).

Many Ukrainian researchers are interested in the development of innovative trends in the tourism sector, focusing on the development of computer and telecommunication technologies. The problem of using innovative technologies in the activities of tourism enterprises is the subject of scientific works of scientists, especially theoretical provisions on the essence of the definition of "innovative potential" in terms of resource, production and integrated approach (Zaitseva, 2020).

The works of domestic scientists describe the characteristics of the terms "innovation", "new product", "knowledge-intensive industry" and "innovation marketing", as well as the study of ways and stages of promoting innovations to the market of goods and services and methods of managing marketing activities (Moskalenko, 2021).

The researcher analyses methods of improving the efficiency of channels for implementing innovative development and analyses marketing activities that promote innovative development.

The development of modern tourism largely depends on the development and implementation of innovative technologies aimed at improving customer service and expanding the possibilities of service tourism. In order to ensure the efficiency and profitability of this service sector, it is necessary to modernise and keep pace with progress. The innovative development of the tourism industry in general and tourism enterprises in particular is currently given the same importance in the scientific literature as the innovative development of the economy as a whole. The specificity of the industry determines any innovation in tourism, primarily the introduction of products with the highest consumer properties at a given time, which can increase the level of satisfaction of existing consumer demand (Chueva et al., 2021).

The joint publication by I. Chueva, L. Nikolaieva and N. Kosareva conducts an empirical study of innovative technologies in tourism activities in the global tourism services market, analyses information on the directions of development of innovative activities in the field of tourism services and their competent application in enterprises of this sector. The main innovative technologies, their content, application and efficiency are described (Chueva et al., 2021).

The researcher O. Cheresniuk considers the thematic issue of planning innovative projects based on a systematic approach and determining the costs of their implementation. As part of the innovation system, the researcher identifies the following elements: analysis of the external environment, analysis of the internal environment, innovation process and lag, and innovation. In order to accumulate information on the process of innovation, the authors have formed an accounting source of information. The model identifies synergistic effects, which include effective behavioural choices of top management, taking into account the price environment, achieving competitive advantages, minimising the impact of market fluctuations and mutual growth of stakeholders' investment confidence in cooperation (Cheresniuk, 2021).

The article by N. Shcherbakova analyses the number of tour operators and travel agencies operating in the Ukrainian tourism market, as well as the number and total cost of tourist trips sold by them. The state of tourism in Ukraine and the process of its reproduction in the post-war period are determined. The article also presents the distribution of tourists by the place of their movement during their holidays and the purpose of their trips in 2020. The article presents the Top 10 countries whose citizens visited Ukraine in 2021 and the countries most frequently visited by Ukrainians. The author analyses the demographic situation in Ukraine due to the war; the situation of tour operators, travel agencies and travel agents; which regions of Ukraine can receive tourists and which are dangerous due to the hostilities (Shcherbakova, 2022).

The article by A. Sydoruk, E. Bortnikova and N. Kyrychenko examines innovative technologies as a promising way of developing tourism and ways to introduce innovations into regional tourism and hospitality development. The influence of the tourism and hospitality industry on the economic development of the country is described. The problems that affect the development of the service sector in Ukraine in modern conditions are identified. The definition of the concept of "innovation in tourism and hospitality" is developed. The objects and subjects of the regional tourism policy, the main types of innovations and possible ways of their implementation in the process of development of tourism and hospitality in the region are allocated. The article also reviews the works of well-known domestic scientists who have studied the essence of innovation, the specifics of managing service enterprises based on the use of innovative methods, and the place of innovation in the regional tourism market (Sydoruk et al., 2022).

In a joint publication, T. Lysiuk, L. Royko and Y. Biletskyi highlight that innovations in the tourism sector are aimed at creating new or changing existing products, improving transport, hotel and other services, developing new markets, introducing advanced information and telecommunication technologies and modern forms of organisation (Lysiuk et al., 2022).

3 Materials and Methods

The theoretical and methodological basis of the study are the basic provisions, scientific works and developments of domestic and foreign scientists on the innovative development of tourism enterprises.

In the course of the study, a set of methods and techniques was used: abstract and logical (when studying the latest publications and practical results on the topic, as well as in theoretical generalisation and formulation of conclusions); analysis and synthesis (when studying the current state and trends of innovation in the tourism services market); system analysis (to monitor the development of tourism enterprises); similar methods (to assess the state and development of tourism enterprises); expert assessments (when studying the specifics of infrastructure provision).

The information base of the study was formed by the relevant legislative and regulatory acts of Ukraine (laws of Ukraine, decrees of the President of Ukraine, resolutions of the Cabinet of Ministers of Ukraine). Analytical and statistical materials of the State Statistics Service of Ukraine, the State Agency for Tourism Development, reports of tourism enterprises and analytical data on the state of the tourism market, as well as the author's own observations were used.

4 Results

At the present stage, the world's interest in Ukraine is simply enormous, and we have to turn it into a powerful tourist flow. However, after the war with Russia, the nature of domestic tourism in Ukraine will change, and it will take some time to recover from the war. When the war is over and we start rebuilding everything, it is clear that domestic tourism will recover economically. Of course, over time, it will recover and undergo

certain changes. Many tourists will go to places that have become symbols of this war. If people used to go to the places of Cossack glory, such as Kholodnyi Yar and Khortytysya, now they will go to the battlefields of the current war.

In this case, it is already necessary to create such tours and excursions so that visitors can understand what happened and tell their children and grandchildren about the struggle and victory in Ukraine.

Some types of sightseeing tours in Ukraine will be unavailable for some time, and beach tourism will have to be forgotten for a while, as demining will continue for a long time. On the other hand, there is hope that the number of post-war beaches will return to the level of early 2014, including in Crimea.

The war is now forcing people to "travel" (flee to safer places) across the country and seek refuge around the world. This situation has made us more united. There are not enough words to express our sincere gratitude to all friendly countries and their governments for their invaluable assistance to Ukrainians. For sheltering children, mothers and the elderly who fled their homes because of the war, providing them with housing, food and everything they need to live. Millions of internally displaced people have returned from other countries, and new friends will come to see this unique corner of Ukraine after the war is over. That is why the recovery of the tourism market is a very urgent issue today, as it is one of the business sectors that suffered the most during the war.

Since the start of Russia's full-scale invasion of Ukraine, some travel companies have closed down, while others have shifted their activities to volunteering - using their buses to evacuate refugees and using their connections to organise the purchase of humanitarian aid from abroad. Since the outbreak of the war, many travel agency owners have turned their offices into volunteer headquarters, and their employees no longer go on exotic trips, but send dry food and medicine to the frontline. Many travel agencies do not intend to resume operations until the fighting in Ukraine ends, but travel companies specialising in short trips to Ukraine have resumed their main tours for several weeks now.

However, there have been requests for excursions: first within Lviv, then nearby in the mountains, and now throughout western Ukraine. Tours of museums and castles that had been closed for a long time have also recently resumed.

The national tourism market of Ukraine is a reformed market in transition, with an average level of socio-economic development and a market structure and tourism industry formed in accordance with macro-regional (European) standards. Due to the terrible war, the current stage of development of tourism enterprises is characterised by relatively low involvement in the global tourism process.

We believe that the recovery of tourism enterprises is possible only under the conditions of an innovative process, which implies the ability to master the media and influence to achieve the necessary profitability and competitiveness. The service sector, as a developing industry, is characterised by an increase in the volume of service production and a rise in risk, which requires an increase in the personal qualities of enterprise managers compared to the existing management organisation. The dynamism of the management process and the manager's intuition are becoming increasingly important. Innovative activities create new types of services, sales and marketing methods that are directly based on increased investment and the development of strategic plans, which, in turn, requires the management of relevant information.

From this point of view, the importance of the basic principle of modern innovation management, awareness, is growing. For companies in the service sector, it is of paramount importance to ensure technology transfer as an independent area of information support for the innovation process.

Monitoring should provide statistically significant factors for service companies that can be used for a reliable assessment of the innovation process. At the same time, an enterprise's activity is based on a model of communication events, and information about the dynamics and quality of their development depends on how these communication events are perceived by the enterprise's personnel.

If an enterprise adopts the concept of organisational innovation in its management system, it may face specific problems, the most important of which is ensuring successful coordination within the enterprise. The solution to this problem lies in rationalising the human potential of the enterprise, the main factor of which is the qualification of employees. High quality and continuous development of personnel should ensure the efficiency and coordination of innovative transformations, which, in turn, contributes to the overall increase in labour productivity.

Successful implementation of organisational innovations requires systemic solutions that require flexible organisation of innovative changes and constant feedback that takes into account the external and internal environment, as well as the parameters of the innovation process and content.

There are four main types of innovative products, depending on their nature and functional purpose (Figure 1). The first category includes new technologies and products, auxiliary equipment and materials. Economic effects include management methods in the fields of science, production and other activities based on forecasting and planning, financing, pricing, incentives and rewards, and performance evaluation.

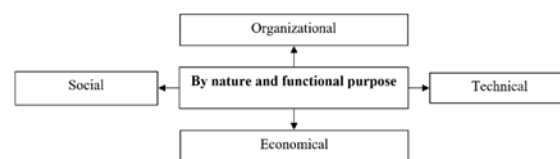


Figure 1: Types of innovations and innovative products
Source: Constructed by the authors

Innovative entrepreneurial activity is a special process of business organisation based on the constant search for new opportunities to improve technical and technological factors of production. It can be described as a socio-economic process that creates new, more advanced goods and technologies through the use of innovations.

The need for such activities is driven by the following factors: the need to improve the technical and technological level of production; increased costs and unprofitable business activities of the enterprise; outdated technologies and equipment; improving the efficiency of production activities through the introduction of innovations; increase in labour productivity as a result of innovation (Kudinova, 2019).

In general, the following main types of innovation activities at enterprises are distinguished (Figure 2).

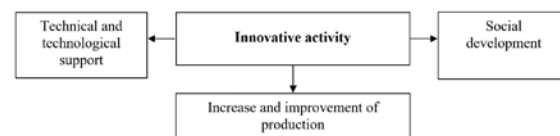


Figure 2: Types of innovative activity at enterprise
Source: Constructed by the authors

At the current stage, the process of restructuring the Ukrainian market is rather slow, and the offer on the travel market is not differentiated and is practically not characterised by exclusivity. Among the global distribution networks, the strongest in the

Ukrainian market are AMADEUS and Galileo, through which travel agencies book airline tickets and other services.

In general, transnationalisation has not yet affected the national tourism market and has only slightly affected it (growth of national tour operators, albeit small and uncompetitive in the international tourism market; attention of transnational hotel groups, the need to form national hotel chains, development of transport infrastructure).

The formation of the national tourism product is based mainly on certain tourist and recreational resources with innovative elements, as well as on a flexible combination of natural, cultural and historical resources, enhanced by the ethnic and religious identity of different regions of the country.

The geographical concentration of tour operators reflects the geographical structure of market demand: it is highest in Kyiv and relatively high in Volyn, Zakarpattia, Ivano-Frankivsk, Kyiv, Lviv, Rivne, and Chernivtsi regions (Figure 3). Data on the concentration of tourism enterprises in the ARC is not yet available (State Statistics Service of Ukraine).



Figure 3. Map of concentration of tour operators in Ukraine
Source: Compiled by the authors based on data from the State Statistics Service of Ukraine

Regions with the highest concentration of tourism operators are, accordingly, generators of tourist flows, although the flow of foreign tourists to our country is almost absent at the present stage during the war.

The effectiveness of innovative tourism activities is manifested in minimising total costs and increasing the profitability of tourism enterprises, as well as in obtaining additional benefits by business entities.

The changing realities of the innovative space for the functioning of tourism enterprises put forward new requirements for determining the status of tourism operators depending on the assessment of innovation potential (Lysiuk et al., 2021).

To study the innovation potential, the Top 10 tourism operators in Ukraine were selected.

To identify the type of innovative behaviour of tourism enterprises, we chose a scale that is a universal means of standardising the values of assessment criteria and allows us to set the corresponding rank of the criterion in the range from 1 to 4 points, where 4 points corresponds to the maximum possible value and 1 point to the minimum (Mykhailichenko, 2015).

Table 1 shows eight evaluation criteria that serve as identifiers of the four types of innovative behaviour of tourism operators.

Table 1: Scales used to assess the type of innovative behaviour of tourism enterprises

№	Assessment criteria	Score in points			
		1	2	3	4
1	Readiness of enterprises to innovate (Rei)	Low	Insufficient	Medium	High
2	Attitude of enterprises to innovation (Aei)	Conservative innovators	Innovators-followers	Innovators-members	Innovators-leaders
3	Innovation intensity (Ii)	Fading	Cyclical	Increasing	High
4	Scale of innovation (Si)	Point innovations	Only product innovations	Some areas of the firm's activity	All areas of the firm's activity
5	Sufficiency of innovation financing (Sfi)	Low	Medium	High	High
6	Information support for innovation (Isi)	Low	Average	Above average	High
7	Availability of resources for innovation (Ari)	Not applicable	Partially applicable	Individual resources are used	Optimal combination of resources is used
8	Spillover effects of innovations (Sei)	Minor effects	Incidental effects	Systematic economic and social effects	Significant economic and social effects

Based on the data presented in Table 1, a range of average values (I) for tour operators was determined. The estimated values for the innovative behaviour of tour operators are presented in Table 2.

Table 2: Assessment of types of innovative behaviour of tour operators

№	Tourist enterprise	The average score according to the criteria of innovative behavior								The mean value
		Rei	Aei	Ii	Si	Sfi	Isi	Ari	Sei	
1	JoinUP	37	36	27	38	37	38	28	32	341
2	TUI	39	38	21	35	24	31	36	27	313
3	Coral Travel	38	38	28	36	34	39	35	22	338
4	Pegaz Touristik	26	28	36	33	34	27	29	35	310
5	TEZ Tour	18	26	18	31	18	27	22	19	224
6	TPG	4	32	29	35	38	38	35	28	344
7	Feyenya (Deppa)	32	38	24	26	27	26	33	32	298
8	Accord-tour (Assopt-rup)	36	34	33	37	31	26	26	34	321
9	Harmalia (Favazn)	21	26	25	35	34	31	21	18	288
10	Pegaz Touristik	31	25	29	34	32	28	26	273	296

By assessing the types of innovative behaviour of tourism operators, we conclude that tourism as a system is highly resilient to external shocks, but after the COVID-19 pandemic and the war with Russia, the negative consequences in the socio-economic sphere will be unprecedented.

To further assess the behavioural, institutional and socio-economic changes in the supply and demand for the products of domestic tourism enterprises, as well as to identify resources to improve their competitiveness, we will use the PEST analysis tool and its extended version, the PESTEL analysis.

This marketing tool allows you to study the main factors: socio-cultural, technological, economic, political, environmental and legal, namely the elements of PESTEL analysis: environment,

technological environment, economic situation, political and legal environment, demographic and cultural characteristics.

Changes in the external environment of tour operators, especially in the case of a pandemic and war, require proper research in order to further predict and develop strategies to combat changes. In our study, we investigate changes in the external environment of domestic tour operators using the PEST analysis method. Political factors often include national stability, tax policy, foreign trade regulation and community development policies. According to the study, economic factors include the business cycle, the contribution of various industries to gross domestic product, interest rates, inflation and employment. Socio-cultural factors include demographics, income, social mobility, changes in lifestyle, behaviour and attitudes to work and leisure, and education.

Technological factors include national research expenditure management, the level of digitalisation of economic sectors, new discoveries and developments, and the speed of technology transfer. Environmental factors include legislation on environmental protection, waste management and energy consumption. Legal factors include a country's antitrust and anti-corruption policies, labour laws, and health and safety (Lysiuk et al., 2021).

However, the speed of the pandemic spread and the war with Russia have made significant adjustments to the list of important factors used in PEST analysis. PEST analysis is a powerful and widely used tool for understanding risks and opportunities as a tool for tourism businesses to adjust their strategies in times of crisis. It identifies the change and impact of the external macro environment on the competitive position of a business unit. We try to understand the external factors and assess how innovation models should evolve to meet their environment. The innovation strategy mitigates the impact of external factors and exploits new opportunities, as a new competitive position can be created in the process.

PEST analysis is most effective when analysing environmental factors in terms of resources, capabilities and key innovations. National tourism is highly volatile and particularly sensitive to cyclical changes in countries of origin, global and regional economic conditions and adverse events such as natural disasters, epidemics, political unrest and terrorism.

As for the social factors of the external environment, in which we consider it appropriate to consider in more detail the employment of the population in the tourism sector, as this indicator is closely related to the impact of the pandemic and the war, there are also negative trends worth noting.

As of the first half of 2021, the total contribution of the tourism industry to employment is 4.8%, while in 2016-2020 this figure was 5.5%~5.8%. The role of vocational education in the tourism industry has increased significantly. Technical factors affecting tourism in quarantine are becoming extremely important.

National courses on the digitalisation of the service sector and communication with customers are leading to major changes in marketing strategies, especially for tourism businesses (Lotysh, 2017).

The rapid development of innovative technologies has made it possible to deepen the personalisation and customisation of services provided. Domestic tourism enterprises have responded to this change in the technological environment by creating personalised interfaces for mobile applications and websites, communicating in messengers, and using social media to collect a large amount of information about their customer base (Moskarenko, 2020).

In order to reveal the tourism potential and opportunities to increase the competitiveness of national tourism enterprises, we use PEST analysis, which allows us to reflect the degree of

influence of external factors of different orientation and importance.

The analysis identifies a list of environmental factors for Ukrainian tour operators, taking into account the consequences of the pandemic and war (Table 3).

Table 3: Factors of the external environment of tour operators

Factors	Degree of influence	Average score					Weighting coefficient / direction
		1	2	3	4	5	
1. Political aspects (Political)							
1.1. Development of international partnerships	2,8	4	3	2	2	3	0,03/+
1.2. Reduction of administrative control over the tourism sector	4,6	5	4	4	5	5	0,04/+
1.3. Strengthening of strategic planning of tourism activities at the national level	4,4	5	4	4	4	5	0,05/+
1.4. War	4,6	5	4	5	5	4	0,05/-
1.5. Restrictions on movement across national borders	5,0	5	5	5	5	5	0,05/-
1.6. The country is in the "red zone" in terms of COVID-19 spread (2019-2021)	4,4	4	5	4	4	5	0,04/-
1.7. Opacity of statistical research	2,4	3	2	3	2	2	0,02/-
2. Economic aspects							
2.1. Exchange rate dynamics	4,4	5	5	5	4	4	0,05/-
2.2. Personal income level	5,0	5	5	5	5	4	0,04/-
2.3. External debt of the country	4,8	4	5	5	5	5	0,05/-
2.4. Declining demand in the service sector amid the pandemic and war	4,6	4	5	5	4	5	0,05/-
2.5. Growing interest in domestic tourism	4,8	5	4	4	4	4	0,05/+
2.6. Tax breaks for individual entrepreneurs during the quarantine and war, suspension of penalties and fines	2,2	3	2	2	2	2	0,02/+
3. Social aspects (Social)							
3.1. Population growth rate	2,6	2	2	3	3	3	0,02/-
3.2. Educational level of the population	4,6	4	5	5	4	5	0,04/-
3.3. Knowledge of foreign languages	2,8	3	2	2	4	3	0,03/-
3.4. Changes in the structure of urban and rural population	3,3	4	4	4	3	2	0,03/+
3.5. Employment rate	3,6	6	4	4	4	2	0,04/-
3.6. Consumer expectations of the population	2,6	3	2	2	2	4	0,03/-
3.7. Changes in behavioural reactions of consumers of tourism services	2,6	4	3	2	2	2	0,03-
4. Scientific and technical factors (Technical)							
4.1. The process of digitalisation	4,2	3	4	4	4	5	0,04/+
4.2. The level of innovation in the sector	2,2	4	2	2	2	3	0,03/-
4.3. Customisation of customer service	6,6	3	3	2	2	2	0,03/-
4.4. Use of e-marketing tools	4,4	5	5	4	4	3	0,05/+
4.5. Possibility of introducing remote forms of service provision	5,0	5	5	5	5	5	0,05/+
4.6. Implementation of logistics and customer self-service systems	4,6	5	4	4	5	5	0,05/+
ALL:						99,2	1

Based on the analysis of the factors of the external environment of Ukrainian tour operators, the main directions of influence of innovative technologies on the competitiveness of the tourism sector were identified (Table 4).

Table 4: Directions of influence of innovative technologies on the competitiveness of the tourism sector

Sphere of influence	Area of influence	Technology
Creation of tourism products	Accelerate the process of creating new tourism products	GDS and other booking systems, Internet
Promotion	Emergence of new methods and technologies for tourism promotion	Internet, webinars, multimedia technologies, GDS
Marketing	Formation of new marketing channels for selling tourism products	Internet, booking systems, e-commerce
Management	Improvement of tourism business management technologies	Specialised software products for tourism business management

Source: Created by the authors

Thus, according to the results of the PEST analysis, taking into account the negative consequences of the pandemic and the war, we have identified the key factors of the external environment of Ukrainian tour operators and the directions of influence of innovative technologies on the competitiveness of the tourism industry.

When selecting the factors, we also took into account their direction of influence and weighted average weight, which allowed us to identify the most important negative and positive components of the external environment of tour operators. It is worth noting that in the strategic planning of innovative activities of tourism enterprises at the national and regional levels, attention should be paid to increasing the importance of such environmental factors as the development of international partnerships, tax incentives for individual entrepreneurs in the tourism sector, and demographic changes.

5 Conclusion

Thus, the study identified reserves for increasing the competitiveness of Ukrainian tourism enterprises in the sectoral market by taking into account additional innovative factors of their external environment. The results of the study have created the basis for further research on the external microenvironment of tourism enterprises at the local, regional and national levels, including an overview and prospects in crisis conditions, i.e. as a result of the consequences of the war with the Russian occupiers.

The rating assessment allows us to identify the most innovative and, accordingly, attractive tour operators for work in the tourism market. Given the multiplicity of rating criteria, its results will allow its participants to indirectly analyse their own work and adjust their strategic outlook for the future.

Based on the relative homogeneity of the tourism resource base, the evaluated tour operators were identified as the main players in the development of tourism in Ukraine, taking into account the specifics of their organisation and activities.

Unfortunately, we are unable to analyse the state of tourism activity in 2022, as reliable statistics are not available due to the war. Nevertheless, we will rebuild our Ukraine, make it better, and we will restore domestic tourism. However, in order to provide quality tourism services in the future, we need to find innovative solutions that will guarantee the safety of tourists and

employees of travel companies. Innovative developments will help ensure the competitiveness of travel companies and enable them to provide high-quality services.

It is well known that tourism in Ukraine has been and will remain one of the most promising industries, as the country has all the conditions for the development of domestic and foreign tourism.

Today, companies are offered a wide range of advanced technologies, including global reservation systems (GDS), integrated communication networks, multimedia systems, smart cards, management information systems and many other systems, to solve various problems and improve the quality of services in the tourism sector.

The future of tour operators lies in chatbots, blockchain technology, artificial intelligence and the Internet of Things. Such innovations are already being implemented in the international travel market, and it is crucial that Ukraine keeps up with these innovations.

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SELF-IDENTIFICATION AS THE LEITMOTIF OF LEV RUBINSTEIN'S MATURE POEMS

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Abstract: The article is devoted to the analysis of the poems by Lev Rubinstein, a representative of the so-called "Moscow conceptualism". Based on the material of the poems "The Appearance of a Hero" (1986), "Mama washed the Frame" (1987), "It's Me" (1995), it is shown that despite the declarative statements of conceptualist theorists about the lack of ideas of modern poetry, Rubinstein tends to the semantic component of creativity, in particular, strives to find and consolidate the place of the lyrical hero of his poems (the alter ego of the author) in the world and in poetry. The motive of self-determination permeates Rubinstein's mature texts of the 1980s — early 1990s and leads him to appeal to non-lyrical genres, in particular to the genre of essays.

Keywords: Keywords: Rubinstein; conceptualism; "The Appearance of a Hero"; "Mama washed the Frame"; "It's Me"; the problem of self-determination.

1 Introduction

The practice of conceptual art of the 1970s and 1980s is complex, ambiguous, and, according to the declarations of the artists of "Moscow romantic conceptualism" (B. Groys), is intentionally purposeless, unfounded, supra-individual. The ways of finding the organizing principles of life, time, space, their cause-and-effect relationships, a person's place in the surrounding world, it seems, do not and should not become the object of creative reflection of conceptualists. Style and form should come to the fore, allowing us to live the discredited norms of socialist realist art and look at the process of artistic creation from a different and unexpected side. Representatives of "Moscow conceptualism", who implemented their own projects mainly in the field of literature (D. Prigov, L. Rubinstein, T. Kibirov, V. Sorokin, etc.), mostly found themselves on this path, playing with form and rising above their own individuality in a "foreign style". Thus, a feature of Vladimir Sorokin's "individual style" became "nobody's style", the artist's willingness to reproduce in each new work any manner and recognizable features of the poetics of the writer-predecessor or contemporary (see about this: Bogdanova 2004).

It seems that Lev Rubinstein, who found himself at the very origins of the conceptualist practices of the 1970s, who became one of the founders and theorists of the conceptualist "Trips out of Town", also moved in this direction. However, as with a number of other conceptualists (and postmodernists in general), the lack of a semantic component in his work turned out to be insurmountable for Rubinstein — the content plan of his poems intensified as the artist gained maturity. Therefore, the relevance of the research is explained by the fact that the creative potential of Rubinstein's poetry has been growing over the years and requires its own thinking.

2 Literature Review

About conceptual verses in Rubinstein's work there is a detailed research of M. Lipovetsky (Lipovetsky 1996, 1997), M. Eisenberg (Aizenberg, 1997), O Bogdanova (Bogdanova 2004, 2023). These and other studies (Groys 1993, Epshtein 2019, Bobrinskaya 1998, Kazarina 2005) formed the basis of our research. Works on

poetology (Trostnikov 1997, Novikov 2001), the peculiarities of inter-genre neoplasms, in particular, on the intersection of prose and poetry (Zhirmunsky 1979, 2001, Lotman 1972, 1973), on the history of the "Moscow romantic conceptualism" were involved in the analysis.

3 The practical significance

The practical significance of the study is that its intermediate and final conclusions, individual observations and judgments can be used in further study of the work of Lev Rubinstein.

4 Rubinstein's Mature Work

If at the early stage of conceptual practices (actions, gestures), the most important component for Rubinstein was to overcome the existing Soviet literary tradition, and mainly at the level of form (creation of objects, generation of the genre of cards, "collective actions" as part of group A. Monastyrsky, etc.) — as overcoming the inertia of social realism, then gradually the poet's own voice began to break through the "total text", to rise above the "planar version" of a copy or reproduction (in the broadest sense of these genre formations), revealing its own logic and its own laws of world modeling (see about this: Rubinstein 1996, 6-7). It is no coincidence that V. Lettsev, defining the difference between Prigov's and Rubinstein's conceptualism, respectively designated them as "aesthetic" and "gnostic" variants (Lettsev 1989, 111), emphasizing the latter's attraction to the deep components of creative intentionality.

Critics attribute the period of maturity of the conceptual poet Lev Rubinstein to the early-mid 1980s (Lipovetsky 1997; Bogdanova 2004; Epshtein 2019). According to the observations of researchers, it was at this time that the existential perspectives of Rubinstein's poetry were contoured, the poet's actualization of the search for "personal identity" and self-determination within the established creative paradigm belongs to this period (Lipovetsky 1996, 1997). The consistent problematization of the subjective component of Rubinstein's poetic texts of the 1980s caused radical changes in his poetics: in a series of deliberately faceless anonymous "card" voices, the image of a lyrical subject began to emerge, whose special world even received a nominative fixation in the poem "The Appearance of a Hero". From that moment on, in Rubinstein's poetic texts, intentions turned out to be aimed at constructing one's own personality, the "lyrical self" ceases to be a working function and is endowed with the features of the author himself. In the poems of this period — "The Appearance of a Hero" (1986), "Mama washed the Frame" (1987), "It's Me" (1995) — there are actually three versions or three stages of the embodiment of author personalization, reflected in the specifics of the plot development, where "the poet's torn self seeks reunion with by himself, persistently seeks self-identification" (Lipovetsky 1996, 213). The way to achieve this goal in each of the poems lies through the conflict of the hero with society, the choice of a particular behavior model turns out to be key in the variable resolution of collisions.

4.1 Problems of self-identification in the poem "The Appearance of a Hero"

For the representativeness of the analysis and identification of the dynamic structure of Rubinstein's "catalog poem" "The Appearance of a Hero" (Rubinstein 1996, 47-57), consisting of traditional cards, we pay attention to the allocation of four types of speech communication in it: polylogue — the voices of many (1-94 cards); narration — the speech of a third person (95-98 cards); dialogue — the speech of two (99-102 cards); monologue — speech (in this case internal speech) of one character (103-110 cards).

The collection of heterogeneous phrases of the conditionally first — polylogical — part of the poem resembles a live queue of strangers (like V. Sorokin's novel "Queue"), whose voices echo

without receiving an answer, or answer each other without hearing a question. The motley picture of conversational discourse demonstrates the inconsistency of communication as a whole, exposing the age-old problem of deafness and misunderstanding between people. Rubinstein skillfully annihilates the personality of each of the sounding phrases, framing it as neutral, recognizable. The variants of situations in which the use of this or that expression is possible are practically innumerable, but a statement that has lost its context, has lost its main communicative function, turns into a template speech formula with which you can start any kind of communication ("Well, what can I tell you?"), continue ("Let's try again") or end any conversation ("Thank you. I have to go"). The author places special emphasis on the fact that a communicative "hole" arises in the sphere of everyday communication, in an area where people are inevitably interconnected. The impersonality and fragmentarity of statements produced by Rubinstein devalues the habitually significant constants — who speaks, what he talks about, why he speaks, etc. Rubinstein creates the effect of a continuous flow of speech, the carrier of which is not a specific hero (there are no actors in the first part of the poem), but society itself, faceless mass.

1. Well, what can I tell you?
2. He knows something, but is silent.
3. I don't know, maybe you're right.
4. It is both healthier and tastier.
5. At the first car at seven.
6. There's more about the student.
7. Come on. I'm just there. <...> (Rubinstein 1996, 47).

Modeling a situation where everyone speaks as one is not only a structural, but also a sense-forming technique. According to M. Berg, "a distinct interest in mass consciousness characteristic of conceptualism and a predilection for the banal, vulgar, marginal and various forms of repressed consciousness were interpreted in such a way that this particular material needed deconstruction more than others, and deconstruction itself contributed to the appropriation of the positions of the field of ideology by the field of literature" (Berg 2000, 115). Indeed, the classical master of Russian poetry, which is used by Rubinstein in the poem, performs not only the function of concatenating heterogeneous isolated phrases, but also deconstructing the phrasal-poetic banality itself.

Deconstruction of the polylogue as a collective consciousness can also be considered another Rubinstein technique — the gradual withdrawal of the main character from the general flow of voices: "There's more about the student", "What's there about the student?", "And where about the student?" (Rubinstein 1996, 47, 49, 53). Impersonal replicas-questions that vary the subject of the student, cling to each other and receive continuation and development. The original narrative strategy is being scrapped, marked by the transition from polylogical communication to communication of not all, but individual hero (voices).

Following the erasure of the boundaries of the collectivity of the polylogue, the poetic dimension in Rubinstein's poem gradually strays into a prose narrative from the third person. Cliches and speech models, designed quasi-poetically, are replaced by the image of everyday micro-plots, which, from a stylistic point of view, are presented dryly, almost documentarily. Scrupulous observation of the emerging hero-student, a detailed description of his simple actions, the use of indirect speech instead of direct speech create a sense of a new genre style — a synopsis. Or, according to the representation of critic A. Zorin, excerpts from school textbooks or dictation (Zorin 1989, 91). An impersonal communicative function, subjected to deformation, undergoes transformation and rushes to zero.

The appearance of the hero-student in Rubinstein's poem is connected with the formation of a familiar everyday world around him, a familiar trajectory of the "school — street — house" movement. But the removal of the character from the mass, from the crowd does not happen immediately. Up to a certain time, the poem is dominated by an impersonal and

depersonalizing space, where each character is nominated and differentiated according to the function he performs: "mother", "classmates", "teacher", "student".

At the same time, in this part of the poem, starting with the 98th card, the circle of characters shows a tendency to narrow, to shrink more and more: from among the heroes "mother", "student", "classmates", "teacher", only two remain — a teacher and a student. Now the impersonal polylogue is replaced by a dialogue of two characters, moreover, in the course of dialogical communication, the interlocutors outgrow their everyday ("school") roles. To a certain extent, their primitive replicas rise to the heights of individualization, since they no longer turn out to be banal common phrases, but quotations from the seventeenth chapter of Confucius' book "Conversations and Judgments".

Addressing Bo-yu (the son of Confucius), the teacher asked: "Have you read the Songs of the Kingdom of Zhou and the Songs of the Kingdom of Shao? <...> Those who have not read them are like those who stand in silence with their faces turned to the wall" (Rubinstein 1996, 55). Or: The teacher said: "I don't want to talk anymore". Tzu-gong (a disciple of Confucius) said, "If the teacher doesn't talk anymore, what will we transmit?" The Teacher said, "Does heaven speak? And the four seasons go by, and things are born. Does the sky speak?" (Rubinstein 1996, 55).

It is noteworthy that Rubinstein almost did not change the original classical text, only omitted proper names. But the context of the original is not lost, because it is known that the name Confucius came from a combination of Kung-tzu, Kung Fu-Tzu (teacher Kun) or simply Tzu — Teacher. The motive of the teacher (and the student) is not only duplicated, but also subjectified. And although before this character also appeared in the stream of voices of the first conditional part of the poem (73rd card: "Is Confucius the fifth century?"), but before the dialogical part of the text, he was not noticeable, was not contoured.

In a conversation with the teacher, the conflict between the collective (mass) and the unit (personality) is concentrated and exposed in phrases-quotations. For example, "The student asked: To dissolve into being or to dissolve into non-being — does it matter? The teacher said, I do not know. And the student left and began to think" (Rubinstein 1996, 54).

At first glance, the mention of the categories "being — non-being" or "life — death" in the dialogue between a teacher and a young student is almost accidental. However, the detailed description of the student, which has already been discussed, depersonalized his any actions. Accordingly, "dissolution" in being, as "dissolution" in the flow of voices, led to the loss of individuality and was equated almost to death. Whereas now, in the atmosphere of dialogue with the teacher, the hero not only appeared, but also thought — in fact, he posed the question of self-identification.

In another episode, the teacher asked: "Have you read Songs of the Zhou Kingdom and Songs of the Shao Kingdom?" The student replied: "No." The teacher said: "He who has not read them is like one who stands silently with his face turned to the wall." The student did not answer. "He went his own way and began to think" (Rubinstein 1996, 55). The fragment is interesting in two circumstances. On the one hand, the image of the hero standing silently, facing the wall, directly refers to the figure of the punished student, that is, who has not yet comprehended the truth, who is mistaken. But, on the other hand, the motive of choosing the path begins to build up in the text: the student strives to stay alone and think. "The student was left alone in the classroom and began to think", "When the guests dispersed, the student was left alone and began to think", "The student left and began to think" (Rubinstein 1996, 54).

Each subsequent (conditional) part of Rubinstein's poem narrows the circle of characters, bringing the main character out

of the mass more and more clearly: set → some quantity → two → one. The movement of the student along this road is carried out, on the one hand, involuntarily, because if you “stop, you will not collect bones” (Rubinstein 1996, 55). On the other hand, it is a movement “to the cherished line”, “to the irrefutable limit”, “to the described boundary”, that is, to the outcome and choice. The hero cannot formulate a conclusion for a long time, because “other voices persistently remind you that you are not alone here” (Rubinstein 1996, 55). But the final phrase of the first conditional part — “Then he thought for a long time” (Rubinstein 1996, 55) — marks the beginning of the hero’s going beyond society, even when he is inside it.

The hierarchy of the characters in the poem (albeit not strict) entails the emergence of other hierarchical levels. Thus, when dividing the text into types of speech communication, the gradation of the stylistic sphere of the language is noticeable. As D. Prigov wrote, “conceptualism — both literary and in the field of art — is characterized by the use of unusual, unconventional languages, such as the language of socio-political and scientific texts, catalogs and quasi-scientific research, and not as quotations, but as the structural basis of works” (Prigov 1989, 419). Rubinstein’s entire text was originally built on a bizarre interweaving of languages framing this or that (hypothetical) situation. But the language level of the poem turns out to be subject to hierarchy: from template speech formulas to the language of scientific and educational publications to philosophical formulas of speech and, finally, to the synthesis of these styles, semantically mediating and filling the meaning of the student’s monologue. The heterogeneity of speech reflects different sides of the surrounding reality, and, as Rubinstein said, now “when comparing different plans, not reality and language collide, but different languages, one of which is designed to replace reality” (Eisenberg 1997, 130).

Rubinstein’s polylogue is a closed structure organized by a four-stop iambic with masculine endings, which will not be broken even if you start reading from any card of the poem. That is, Rubinstein does not care about the content of phrases, but their very combination, their internal logic. At the same time, the absence of the addressee deprives the replicas of directional movement, and the replicas deprived of a vector form chaos that accommodates an empty impersonal space. According to A. Zorin, “Lev Rubinstein’s poetic world turns out to be populated by voices echoing as if in a void devoid of bodies” (Zorin 1989, 91).

However, the silence of the student becomes a contextual synonym for the thought process. As a result, not only the finale, but also the entire text of the poem “The Appearance of the Hero” turns out to be permeated by the thought of one passing through the speech of many. Accordingly, by the end of the poem, Rubinstein’s character is no longer perceived as a schoolboy, not as a listener and student, but as a character who is approaching (or trying to approach) the solution of the mysteries of existence. The motive of self-identification is concentrated around the hero who is gaining maturity.

4.2 The motif of childhood memories in the poem “Mama washed the Frame”

Lev Rubinstein also refers to the figure of the maturing hero in the poem “Mama washed the Frame”. But unlike the “Appearance of the Hero”, the narrative strategy of this poem is a first-person statement addressing moments of the past, childhood memories or old photographs.

The artistic world of the poem “Mama washed the Frame” is organized by a set of the most familiar everyday moments of various plot and emotional saturation.

7. It started to rain.
8. Brother teased brother.
9. The milk ran away.
17. The disabled person burned down in the car.
18. We went to the forest.
19. Grandma had cancer (Rubinstein 1996, 68-69).

Short, simple syntactic sentences and the immediacy of the presentation of events recreate the “telegraphic style of memory” (Eisenberg 1997, 151).

They record either the action (“We went to the forest”, “Dad quit smoking”), or the subject and his distinctive features (“Yulia Mikhailovna was strict”, “Igor Dudkin was like a Georgian”). The childishness of the manner of speech is manifested in the very construction of the phrase, for example, in the deliberately incorrect use of the opposite conjunction: “The Sorokins had plums, but there was also Jack” (Rubinstein 1996, 69). A special tuning fork role is also played by the title phrase — “Mom washed the Frame”, borrowed from the context of school reading exercises and placed in the epic field of the poem.

At first glance, the phrase “Mom washed the Frame” as an introductory sentence reduces the drama of life’s vicissitudes that arise as the plot develops, and unifies all subsequent statements (so, almost every phrase acquires a distinctly quasi-literal sound: “The guys played volleyball in the clearing”). That is, the composition of the text creates a situation of impersonality and mass character comparable to the “Appearance of the Hero”. But if in the 1986 poem the lyrical hero outgrew his conventional role of a student from a collection of problems, then in this text the author explicates the character’s connection with the world of the primer. The world of ABC truths seems to the subject of the narrative more comfortable and safe than the external environment.

Rubinstein reproduces a child’s vision of the world, which is expressed not only in the representation of objects of reality, but also in the very choice of “plot” episodes. More than half of the poem consists of listing the names of those people who were previously part of the character’s social circle, and now pop up in the memory of the lyrical subject. This layer has a function similar to the polylogue of the preceding poem: the text of the memoirs outlines the environment of the hero, recreating his character context, but in addition it also becomes a sign of his “pedigree”, the path to his self-identification.

It is significant that for the first time the voice of the lyrical hero appears in the poem “Mama washed the Frame” on the twenty-first card and is introduced into the narrative indirectly, through the figure of the grandmother: “20. The grandmother died in her sleep. 21. I often saw my grandmother in a dream. 22. I was very afraid to die in my sleep” (Rubinstein 1996, 69). It is curious that the “birth” of the subject in the text occurs as if in the atmosphere of the news of the death of a relative, as if illustrating the act of continuing life and changing generations.

The next appearance of the hero will take place fifteen fragments later and will again be tied to a story about another: “35. Sasha Smirnov was jealous of what brands I had. 36. He could move his ears. 37. Then I learned” (Rubinstein 1996, 70). A passing mention of himself illustrates the specifics of the consciousness of the hero-child, the identification of himself through the environment. The hero feels like a part of society, but the relationship in which he is with him turns out to be a relationship of subordination and dependence. Germination of the hero from the environment does not give him (contrary to expectations) a sense of confidence and security. The content of the cards in which the lyrical subject appears is inextricably linked with the motives of weakness and fear: “I was very afraid to die in my sleep”, “I was afraid of Tanya Beletskaya’s doll”, “One day I almost burned out”, “I was shy about my name”, etc.

Contrasting with the feeling of “inferiority” of the hero are fragments with the actions of others: “Yura Stepanov made a hut”, “Vova Avdeev fought”, “Sergei Alexandrovich joked with dad”, “Gleb Vyshinsky brought a mouse” (etc.), among which episodes stand out where the actions of the characters are directed at the lyrical hero: “Sasha Smirnov was jealous of what brands I had”, “My brother hit me because I was laughing and making faces”, “I was not allowed to cross the road”. As in the cards characterizing the hero, here again the situations of pressure on the character vary in one way or another.

Gradually, the text of Rubinstein is filled with disturbing notes, intensifying towards the finale and resolved by a terrible thunderstorm. The motive of the storm, only outlined in the "Appearance of the Hero", becomes a leitmotif in this text. If the third card only represents — "The wind was blowing", if the seventh states — "It started raining", and then both phenomena seem to subside, then after forty-three fragments, the wind and rain return, but in an amplified sound. The premonition of a frightening coming thunderstorm is complemented by household troubles that are forcing the atmosphere: runaway milk, falling tension every now and then, a loud cry from dad, finally, the echo of a thunderclap (card 34) and the rumble of a heavy chain of a yard dog.

By the end, the fusion of complementary storylines is marked by the highest point of emotional tension, which blocks the ability to logically construct thoughts, breaks the syntactic structure of phrases, leaving them unsaid, cut off in mid-sentence.

70. One day, entering Gali Fomina's room without knocking, I saw for the first time.

71. One day, possessed by terrible premonitions, I rushed in.

Emotional shock serves as a barrier to the verbal expression of the feelings of the hero, who, trying to find the most appropriate form of presentation, again strays into a childish incorrect manner of speech organization: "73. The wind raged all night, there was also a thunderstorm" (Rubinstein 1996, 73).

The process of growing up of a hero, more or less successfully passing life tests, in the poem "Mama washed the Frame" is actualized not by plot (as in "The Appearance of the Hero"), but at the level of rhythm. In an attempt to express himself, the lyrical subject imperceptibly proceeds to the rhythmization of each individual phrase (cards 74, 75, 76, 78, 79, etc.).

The appeal to the four-stop iambic and high topic transforms the text space of the poem: the angle of view of the hero changes dramatically, the narrative departs from trivial plots, the picture of a well-coordinated life is opposed by a raging element. It is indistinguishable who is the addressee of rhythmically organized replicas — the adult instance of the lyrical subject or the language itself, which has come into its own. But the statement of bad weather, the landscape plan, embodied in the style of neutral vocabulary, is consistently poetized. Thus, the card 75 ("Thunder struck, boredom arose, confusion foamed in the chest") has a romantic character, anticipating the appearance of a whole quatrain rhyming *abab* (in Russian) with alternating female and male rhymes.

Initially seemingly "childish", the poetic lines acquire a classic Pushkin sound, which also appeared in the first part of the "Appearance of the Hero". It is noteworthy that in both poems, those passages that represent the dynamics of rapprochement with the area of chaos are subjected to rhythmization. The rhythm and poetic structure seem to stand in the way of overcoming the confusion and fear of the lyrical hero, in this text forming a psychological landscape permeated with the sounds of hail and raging wind, but "pacified" by the rhythmic structure of the narrative.

The question arises: how does the poem "Mama washed the Frame" reflect the process of self-identification of the hero? The idea sounded above that the hero is "born" by the collective (family) and the child subconsciously feels like a part of it, although being in a position of dependence on the majority. However, as the poem is read, it becomes clear that the events and names filling in more than fifty cards do not really have independence, but come back to life only thanks to the memory and memories of the lyrical subject. In Rubinstein, he becomes a connecting link, a core from which all — essentially independent — characters grow and appear. Thus, a specific understanding of the self is explicated ("everything is in me, and I am in everything"), subsequently developed and strengthened in the next poem — "It's Me".

In the text "Mama washed the Frame", the lyrical subject acquires a biography, or rather even an autobiography, a historical context and a system of real relations with the environment. At the same time, the world of childhood, described on behalf of the child hero, is reflected by the consciousness of an adult: "One day I saw such a huge caterpillar that I can't forget it until now" (Rubinstein 1995, 72). The phrase "until now" implies finding the subject of speech outside of the described situation of the past (once, sometime). And if the micro-plots of the poem unfold in the past tense, then the conflict of the poem is produced by the dialogue of two consciousnesses: a child, flawed due to its smallness and insignificance, and an adult, gravitating towards a world that really no longer exists, but whose reflection it carries within itself. A thunderstorm that takes with it naivety and simplicity of perception becomes a metaphor for the relentless passage of time and a direct indication that one person is unable to resist the twists of fate.

Realizing the frightening spontaneity of this world, Rubinstein's hero seeks support in the collective (generic, family) beginning, without identifying himself as an adult with himself as a child and with others. Thus, in the poem "Mama washed the Frame" Rubinstein takes another step towards epistemology, leaving behind the conceptual practices of abstraction and formalism.

4.3 The lyrical subject in the poem "It's Me"

The poem "It's Me" is the last catalog work by Lev Rubinstein, outwardly reminiscent of his conceptualist practices of the 1970s and 80s. According to M. Lipovetsky, this poem carries a "distinct shade of programmacity" (Lipovetsky 1996, 213), since the issue of self-identification is revealed here most fully, absorbing the development of the topic within the framework of previous poem texts.

The compositional structure of the poem, even in comparison with "Mama washed the Frame", acquires features of even greater life-likeness. The plot side of the narrative reproduces the process of viewing, turning over a stack of old photos from a family photo album.

It may seem that Rubinstein inherits the well-known technique of flipping through the "album", once carried out by conceptual artists I. Kabakov or V. Pivovarov. However, in the poem "It's Me", as in "Mama washed the Frame", and unlike Kabakov and Pivovarov, the level of autobiography is quite high: the hero (close to the author's alter ego) mentions parents, brother, grandmother and other relatives. Unlike the previous poems in "It's Me" Rubinstein attempts to accurately indicate the historical epoch (names the dates: 1952, 1940, 1954). Meanwhile, the pictures themselves, the photos of the family archive are invisible in the text, there is no visual component. Instead of photos that "themselves turn out to be a record (of a place, time, state of things, characters), a text-for-reading" (Aronson 1999), the author offers to consider their reverse side — the white basis of the photo with a comment: who or what the frame recorded.

The metatextuality inherent in many of Rubinstein's works is coming into its own. The restrained enumeration of the people in the group photo, with a division into those who are standing and those who are sitting, is unexpectedly colored by the stylistics of a lyrical digression.

15. Lazutin Felix.
16. (And someone's hand writing something on a piece of paper.)
17. Golubovsky Arkady Lvovich.
18. (And a drop of rain running down the glass of the car.)
21. Kosheleva Alevtina Nikitichna, a cleaner.
22. (And the TV announcer's lips moving soundlessly.) (Rubinstein 1996, 142).

Thirty fragments of text turn out to be an explication of what the camera is not able to fix. Memories become objects of contemplation and careful storage in the memory of the hero. It

is obvious that in fact they are not correlated in any way with the reproduced names: the comments are literally put out of brackets. However, it is the different timing of the fragments that gives the invisible visual series a subjective poetic shade, makes the perception of an essentially quite trivial moment of viewing photographs lyrical.

It is noteworthy that Rubinstein offers an album of photographs in which, along with images of places and people, there are a dried leaf, a flower or a cut strand of hair — those insignificant objects from the point of view of an outsider that evoke in the lyrical hero not only memories, but also feelings. Rubinstein's card file turns out to be a register of memory, but with a caveat: the poet collects not images or views, but feelings, the personal attitude of the perceiving subject to the contemplated.

To convey the subjectivity of the perception of the lyrical hero, the author uses rhythmic and graphic design of phrases. According to M. Lipovetsky's observations, "all odd cards are given to names, and all even cards of the fragment are given to meditations. In addition, meditative phrases are correlated with each other not only by anaphora (which is generally common with Rubinstein), but also by a distinct syntactic parallelism" (Lipovetsky 1996, 213).

The text of the poem is filled with symphonic intonation, the development of the plot is accompanied by the consistent entry of new possibilities into the game — for example, Rubinstein attracts a rhythmic drawing of classical size, Pushkin's iambic tetrameter, which is almost familiar to him (cards 36-38, 51, 53, etc.).

In the melody of the text (as in "Mama washed the Frame"), one note begins to appear — a note of anxiety. The prose and metrized fragments "somehow vary the motif of pain, abomination, weakness" (Lipovetsky 1996, 214), already touched upon by the material of the preceding poem. Premonition of trouble and anxiety are motives that not only unite poems of different years, but also become the background for the maturation of the leitmotif. The search for auto-identity in the hero of Rubinstein is obviously accompanied by trials and difficulties: with their help, the central character of the poem undergoes a certain rite of initiation, after which he will be able to get an answer to the main question of life: "Who am I?"

However, the initiation of the layman into the knowledgeable presupposes the abandonment by the applicant of the habitual way of life and worldly claims, the rejection of his past, the liberation of consciousness from stereotypes and clichés. Therefore, the image of a storm shaking the ground under the hero's feet — "Everything was above me as before, but the firmament was shaking under me" (Rubinstein 1996, 93) — can also be interpreted as the rebirth of a lyrical subject. A thunderstorm in this case appears as a ritual of ablation, and the final phrase-the card "I got up, dressed..." — is an illustration of the ritual of secret societies to dress a neophyte in new clothes.

Meanwhile, the readiness of the lyrical hero for change is not obvious. Rubinstein's character tries to realize the deforming reality, to reach its "limit", "milestone", but at the same time does not take a single step, being shackled by doubts. The student's uncertainty — "suddenly there won't be enough for the last effort" — contributes to the growing sense of anxiety in the poem of 1987 and its accumulation in the texts of subsequent years: "71. Or imagine that you are in constant anticipation of some unknown catastrophe. 72. And, obviously, that's why you instinctively resist any life changes" (Rubinstein 1996, 127).

Anxiety fills the poem "It's Me", reaching an emotional peak in cards 56-62 and transforming into the theme of "mental and bodily trembling" (Kazarina 2005, 427). It is noteworthy that this tremor for the first time covers a child character: "And we see six or even seven bright orange pills on a trembling child's palm", the main object of identification of all the analyzed poems. And only later resonates in the intertextual Pushkin images of classical literature.

57. And the dueling pistol *trembles* in the hand of the lame officer.

58. And a French novel, opened in the middle, *trembles* in the hand of a young lady.

59. And the silver snuffbox *trembles* in the pale young man's hand.

60. And the tin cross *trembles* in the hand of a drunken soldier.

61. And a large silver samovar *trembles* in the hands of a drunken military doctor.

Verbal design receives a unique Rubinstein understanding of the self as a set of what the lyrical hero heard, read, saw, experienced. The personality of the hero is finally recreated at the intersection of his own and someone else's: other people's names and the names of parents, literary quotations and character statements — the subject is understood as a chaosmos in which the whole world experience is concentrated. Therefore, "literary samples of the destinies, mostly suffering, unhappy" (Lipovetsky 1996, 215) from independent texts turn into variations of the drama of a through lyrical hero. At the same time, Rubinstein's attention is focused not only on quasi-literary narratives, but also axiologically significant allusions to the classics: the initial fragment of the poem evokes an association with the second stanza of the first chapter of Pushkin's "Eugene Onegin". In card 60, an episode of Dostoevsky is guessed: a meeting of prince Myshkin with a drunken soldier who sells his "silver" to the prince, but in fact a tin cross. And the text ends with a reference to the famous "Raven" by Edgar Poe. Probably guided by the belief that personal identity turns into a collage of borrowings and reflections of someone else, Rubinstein uses quotation marks in the title of the poem — his lyrical subject also turns out to be a quote.

Meanwhile, in the fact of the hero's mimicry in the surrounding world, one should not see the surrender of the individual to the collective, its adaptability. On the contrary, this position is an expression of a new understanding of subjectivity in the conditions of conceptual art. Subjectivity as a fluid, but always unique combination of various elements of the repeatable or "alien": words, things, quotes, gestures, images, etc. Finding oneself in Another saves not only from a "storm" or "life catastrophe", fusion with Another (Others) is equivalent, according to Rubinstein of the 1980s – 1990s, immortality. "When you get tired of waiting for trouble in your native corner, remember the wet footprints on the freshly washed floor", where the footprints turn out to be a metonymic substitute for society.

The representation of captions to photographs contributes least of all to the disclosure of the plot of the picture, but intensifies the associative mechanism of memory — impersonal details and fragmentary thoughts pull a string of images from which the image of the lyrical subject emerges.

113. And this is me.

114. And this is me in shorts and a T-shirt.

115. And this is me in my underpants and a T-shirt under a blanket with my head.

116. And this is me in underpants and a T-shirt under a blanket running headlong on a sunny lawn.

117. And this is me in my underpants and a T-shirt under a blanket running headlong on a sunny lawn, and my groundhog is with me.

118. And my groundhog is with me.

119. (Leaves.)

The past grows in the present, a change in the place and time of action does not imply a change in the subject of perception, which is directly indicated by the verse line: "Many years have passed since then, and you are still the same as you were" (Rubinstein 1996, 141). Being in the dimension of childhood, and the hero of the three named texts is a child (student), gives the author the opportunity to return to the start of life again and again and to comprehend the plot of "self-writing" and "self-reflection".

5 Conclusion

Summing up, the following should be recalled. In an interview, Lev Rubinstein noted that the poem “It’s Me” drew a line at a certain period of his work and approved in the decision to complete his filing in a meaningful way. Later, Rubinstein will move on to a new form of utterance — the genre of essays. But it was the poems about the student that led Rubinstein to such a choice. According to him, the idea of non-fiction has been developed by him since the late 1980s by introducing “direct autobiographical memories” (Rubinstein 1997, 185) into the text of poems. Turning to external realities, events of personal and public life, singling out one “student” voice from the hum of voices, Rubinstein managed to construct the character of subjectivity that made his transition from poetry to memoir prose organic. The problem of self-identification turned out to be closely intertwined with the immanent development of Lev Rubinstein’s poetics as a whole.

6. Prospects for further research

Concluding the analysis of Rubinstein’s conceptual texts, we can say that his practices contained the foundations of the theoretical base of the “Moscow conceptualism”. But against the background of the “unprincipled” creativity of conceptualists, Rubinstein began to detect trends in the search for meaning quite early — the search for meaning in literature and in life. His texts gained more and more semantic content from year to year, turned out to be focused on the most important issues of human existence. Further study of Lev Rubinstein’s lyric and epic texts will allow us to discover new components of his ambiguous creativity.

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IMPACT OF THE FACTORS OF THE GREEN DEAL TO SMART MOBILITY

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Abstract: The Green Deal aims to protect the environment and has a significant impact on the automotive industry. The Smart Mobility approach makes it possible to better implement sustainability in the automotive industry. This thesis examines the impact of the Green Deal on smart mobility. After a methodical literature research and an online survey, which was evaluated with linear regressions, the thesis comes to the conclusion that Smart Mobility and the Green Deal are strongly interrelated. Sustainable change in the automotive industry will probably not only be achieved through electromobility, but also requires new mobility concepts.

Keywords: green deal, smart mobility, digital transformation, business model

1 Introduction

The Green Deal aims to protect the environment and has a significant impact on the automotive industry. The Smart Mobility approach makes it possible to better implement sustainability in the automotive industry. This thesis examines the impact of the Green Deal on smart mobility. After a methodical literature research and an online survey, which was evaluated with linear regressions, the thesis comes to the conclusion that Smart Mobility and the Green Deal are strongly interrelated. Sustainable change in the automotive industry will probably not only be achieved through electromobility, but also requires new mobility concepts (Rukanova et al., 2023). The EU is to be transformed into a modern, resource-efficient and competitive economy. The aim is to achieve climate neutrality in the EU by 2050. At the same time, economic growth is to be decoupled from resource consumption (Vinodh, Jayakrishna, 2013). The EU also focuses on the entire life cycle of products (Thormann et al., 2023). Other factors, such as water consumption, must also be taken into account in the production of cars (Semmens et al., 2014). The ecological footprint of the automotive industry needs to be reduced in many areas. Manufacturers' own reporting on sustainability is often difficult to verify and lacks transparency, so there is still room for improvement here too (Molnár et al., 2023). At is also difficult for public authorities to access the relevant data (Rukanova et al., 2023). According to the Paris Climate Agreement, global warming should be slowed to below 2 degrees Celsius, preferably 1.5 degrees Celsius (Konewka, Czuba, 2022). This also results in the need to combine sustainable and intelligent mobility. It can be assumed that sustainable mobility also requires intelligent mobility in many areas. Simply replacing combustion vehicles with electric vehicles is only an improvement in terms of local CO₂ emissions. In many areas, sustainable and environmentally conscious mobility solutions are only made possible by intelligent mobility and the digital transformation. The aim of this article is to answer the research question:

"To what extent do the specific measures and objectives of the Green Deal influence the acceptance and implementation of smart mobility solutions among automotive customers in terms of environmental friendliness and sustainability?"

Nevertheless, we must first consider the CO₂ emissions from the transport sector. In 2020, the Covid-19 pandemic also helped to reduce emissions in the transport sector by 13 percent. However, car manufacturers have suffered considerable losses during the coronavirus pandemic (Kucera, Ticha, 2021). The European share of global CO₂ emissions from transportation amounted to around 15% in 2020. Other global emitters such as the USA and the South Pacific region account for around 30% and 33% respectively. Within the EU, transportation accounts for 25% of total CO₂ emissions. Passenger cars and light commercial vehicles account for 12% and 2.5% of total CO₂ emissions in the EU respectively. Electric vehicles therefore have a significant

role to play in reducing the respective greenhouse gas emissions. In their work, Konewka and Czuba assume that electromobility will create a kind of new industry within the EU. The known supply bottlenecks also meant that customers were more likely to buy hybrid and electric vehicles, as these were prioritized by manufacturers. In 2021, the share of electric and hybrid vehicles was already 19.2% compared to 11.4% in the previous year (Konewka, Czuba, 2022). In their agreement in Rome, the European member states also adopted a common transport policy. The focus here is on the harmonization of this policy, whereby this mainly relates to legal, technological, social and fiscal aspects (Konewka, Czuba, 2022). It is also important for companies and large manufacturers to recognize their own responsibility beyond political or public pressure and to work on these issues with intrinsic motivation, so that innovations and improvements can be made along the entire value chain (Broch et al., 2015). Other studies come to the conclusion that companies should create their own innovation culture (Troise et al., 2022).

In addition to looking at CO₂ emissions, it is also important to clarify the economic importance of the automotive industry within Europe at the beginning of this paper. In 2021, around 12.7 million people were employed directly or indirectly in the industry, which corresponds to around 6.6% of total employment in the EU. Production alone employed 2.6 million people, making the automotive industry important for the economic stability of individual countries within the EU (Traverso et al., 2015). The most important sales regions for the automotive industry are the EU itself, the USA and China. In 2021, 9.9 million cars were produced and 9.9 million cars were registered within the EU. This corresponds to 16.1% of global production and 15.7% of global registrations. However, the figures for 2021 must be viewed somewhat more critically, as the figures were lower due to the coronavirus pandemic and global shortages of materials and chips. The figures for 2022 were also only around 10.9 million cars produced in the EU, compared to around 15.8 million before the coronavirus pandemic (Konewka, Czuba 2022).

As part of the Paris Climate Agreement, the Green Deal aims to achieve the climate protection targets more quickly and also states that economic benefits can be achieved by achieving the Green Deal. By 2030, the EU is to reduce its CO₂ emissions by 55% compared to 1990 levels. Originally, a reduction of only 40% was planned. Car manufacturers and mobility providers have a duty to provide answers to these questions. Traffic-related emissions are now higher than in 1990 (Haas, Sander, 2020). Car manufacturers must now focus on electromobility and / or hydrogen drives in order to meet the new targets. It has become a balancing act for politicians and car manufacturers to find the optimal solution between the challenges of environmental protection and the economic goals of companies. However, this is also where the approaches for smart mobility arise, which can have a positive influence here (Reichenbach, 2020).

Under the Green Deal, the EU should have achieved climate neutrality by 2050. Emissions trading in the EU also plays an important role in this. The aim is also to strengthen emissions trading within the EU through a sensible carbon price (Claeys et al., 2019). In the transport sector, this can only be achieved through predominantly electrification or suitable hydrogen vehicles. Trading in emissions certificates is also at the heart of the Green Deal. The price of CO₂ will rise continuously over the coming years. It should also be noted that climate protection targets are being tackled to varying degrees around the world. The Green Deal further intensifies the different ambitions with regard to climate protection. It should also be noted that the achievement of climate protection targets must not be accompanied by a deterioration in the EU's competitiveness. In the view of many scientists, this is one of the greatest challenges in implementation. In the opinion of many researchers, a stronger focus goes hand in hand with a deterioration in

international or global competitiveness, as more climate protection often has a negative impact on economic performance. In the field of automobility, this specifically means that synthetic fuels must also be prioritized more strongly. At the same time, Löschel believes that an even greater focus will have to be placed on product and process innovations (Löschel, 2020). In their 2023 study, Yi et al. found that the state and politics in particular have a very large influence on the achievement of climate protection targets (Yi et al., 2023). Even well thought-out individual measures, such as optimizing the vehicle paintwork, can already save a lot of CO₂, whereby this can already be around 24% in the case of paintwork (Wendt et al., 2023). At the same time, however, it must also be noted that even sustainable products continue to emit CO₂. Wind turbines and modern electric cars also require steel, metals and plastics for their manufacture and production. According to Wyns and Khandekar, it can be assumed that the sustainable transformation is tantamount to an industrial revolution (Wyns, Khandekar, 2019).

In addition to the research question already mentioned, three topics were to be examined in particular with regard to the users. These include the change in transport behavior, the acceptance of new technologies and the development of environmentally friendly transport solutions.

2 Literature research

The literature research for this paper shows that there have been no specific studies to date on the effects of the Green Deal on smart mobility. However, there are various works that deal individually with the topics of the Green Deal and smart mobility. The relevant findings from this literature research are now summarized here as follows.

2.1 Green Deal

This also raises the question of what the Green Deal means for the automotive industry in concrete terms. As part of the Green Deal, car manufacturers must reduce average CO₂ emissions by 37.5% between 2021 and 2030 (Wyns, Khandekar, 2019). In their analysis from 2020, Haas and Sander come to the conclusion that accelerated ecological modernization instead of a socio-ecological transformation is the right way to positively realize the implementation of the Green Deal. In their study, they also come to the conclusion that limiting the fleet thresholds is neither aimed at reducing the volume of traffic nor at a shift towards environmentally friendly modes of transport. In the view of Haas and Sander, a far-reaching change in transport policy is necessary. The ecological improvement of cars therefore has little effect on an actual change in the traffic situation. As a rule, German car manufacturers in particular have not been very ambitious in pursuing fleet limits in recent years. At the same time, the scandals of recent years, such as the diesel scandal, have not helped to improve the image of the industry (Wellbrock et al., 2020). At the same time, the regulations contain many exemptions, which is why there has hardly been any reduction in real emissions values. Haas and Sander also stated in their 2020 paper that the success of the European Green Deal also depends heavily on the various strong forces of lobbying. The automotive industry in particular continues to have a very strong lobby. However, it is clear from their analysis that the transport sector in particular needs to change. Based on the work of Haas and Sander, there is also a need for further research, which can be answered here in the context of this thesis. The influence of the Green Deal on smart mobility also raises the question of whether sustainable and ecological change in the mobility sector can also be achieved by changing the awareness of users and people with regard to the entire transport situation. It therefore remains questionable at present whether a pure focus on ecological factors is sufficient to actually implement the necessary measures of the Paris Climate Agreement and the Green Deal? Furthermore, Haas and Sander also address the aspect that the transport sector is already facing major changes due to digitalization and automated driving (Gidebo, Szpytko, 2020). Haas and Sander's recommendation

that mobility should be placed more strongly within the framework of social relationships is also interesting for further research in the context of this study. The questions of the Green Deal also go hand in hand with questions of mobility justice. This aspect must also be taken into account, as electric cars in particular are currently still more expensive than classic combustion vehicles (Haas, Sander, 2020). Compliance with EU legislation in terms of solidarity, sustainable development and a high level of environmental protection must also be achieved (Sikora, 2021).

The effects of the Green Deal continue to be of great importance for electromobility. From the EU's perspective, passenger cars and light commercial vehicles are also a strong driver of innovation, efficiency and competitiveness with regard to the Green Deal. However, the implementation of electromobility also requires a high degree of further implementation in the countries, particularly with regard to the appropriate charging infrastructure. Countries in which there is a high level of social understanding for environmental protection are particularly successful in this regard. In their work, Konewka and Czuba also come to the conclusion that governments must promote the purchase of electric vehicles with subsidies, discounts and incentives. New providers and start-ups will enter the electromobility market and thus promote new technologies. In this context, battery costs in particular should be further reduced through new technologies. Konewka and Czuba also assume in their work that understanding customer needs will become a key issue. This is particularly relevant for markets in which a new product is to be launched. From the perspective of this study, the question also arises as to whether smart mobility can be used positively for customer understanding with regard to sustainability and the Green Deal. Konewka and Czuba assume that the uncertainties regarding the electric cars to be introduced go hand in hand with potential customers' acceptance of the new technology. Customer acceptance remains one of the most critical issues in the development of further sustainable drive systems (Konewka, Czuba, 2022). Rafieefar also points out in her work that the political focus is very much on electromobility, but that other topics and ideas that can be achieved through digitalization and sustainability tend to be largely ignored, even though they may have even greater ecological and social benefits (Rafieefar, 2022).

In another study by Peyravi, Peleckiene and Vaičiute, the authors come to the conclusion that technological progress is the main criterion for reducing climate change in the vehicle sector. In addition, the authors believe that public administration is called upon to improve alternative usage concepts and the like in such a way that electric vehicles and other mobility options are used more effectively (Peyravi et al., 2022). Omahne, Knez and Obrecht also assume in their analysis that sustainability and electromobility will become one of the most important topics in the area of sustainable cities and municipalities in the future (Omahne et al., 2021). The work of Omahne, Knez and Obrecht is also interesting in that it shows specifically in which areas the topic of electromobility and the Green Deal has not yet been sufficiently researched. An extensive literature review was carried out as part of their work. This made it clear that there is a lack of literature to date on the effects of electromobility on social well-being and the user experience. The general acceptance and perception of electric cars has already been studied extensively, although the image of electric cars, specifically their perception as a status symbol, has not been studied very intensively. Overall, it can be seen that the literature often fails to provide a comprehensive analysis of electric mobility and thus also of social measures. The investigation of social readiness is also very important here, as the increasing spread of electric cars also goes hand in hand with the positive perception and acceptance of the population (Omahne et al., 2021). However, the analysis by Omahne et al. also made it clear that it is precisely those cities and countries in which the political requirements, such as the EU's Green Deal, are being implemented in a focused manner that are paying more attention to electromobility. Their work also makes it clear that the connection between sustainability and affordable energy as well

as affordable electric mobility has not yet been investigated much, although this is certainly indispensable for a large part of the population. In the current literature, the topics of user experience, social readiness and welfare are also missing when considering electromobility (Omahne et al., 2021). At the same time, increasing competitive pressure requires the digital transformation of the industry anyway (Singh et al., 2021). Other studies also come to the conclusion that digital transformation is positively linked to company performance (Chouaibi et al., 2022). In their work, Llopis-Albert et al. discuss how the automotive industry is being disrupted by the digital transformation. This includes aspects such as connected and autonomous driving, digital sources of information when buying a car, big data and electric vehicles, but also mobility as a service, where car ownership is increasingly being pushed into the background (Llopis-Albert et al., 2021). Li and Yang's analysis comes to the conclusion that modern large corporations and manufacturing companies can no longer succeed in the digital transformation alone. Cooperation is therefore becoming increasingly important. Large corporations in particular should increasingly focus on technological innovation and the introduction of new technologies (Li, Yang, 2021). Furthermore, the technological innovations of individual companies also have positive effects on the overall economies of the respective countries. Economic expansion therefore also leads to greater prosperity and a higher level of employment across the board (Galindo-Martín et al., 2019). The analysis by Li et al. has made it clear that companies that consider digital transformation are more likely to have a digital technology infrastructure and a strategic focus on digital infrastructure. This also enables these companies to respond better to environmental turbulence in the market (Li et al., 2021).

Energy sources for electromobility are being promoted for modern drives in particular. The study by Llopis-Albert et al. comes to the conclusion that manufacturers will ultimately have higher profits, productivity and competitive advantages if the digital transformation is implemented. For consumers, the authors of the study expect better and more services and greater satisfaction. The authors also assume that the nature of new products and new services in the automotive market will be favored by government legislation on environmental issues and high consumer demand anyway. The study also comes to the conclusion that all stakeholders expect improved or new digital offerings in order to achieve greater satisfaction. The focus of these offers is often specifically on cost-effective, economical and autonomous electric cars that take into account the use of efficient renewable energy sources. According to Llopis-Albert et al., companies with a leading role in digital offerings in the automotive industry will gain a competitive advantage. From the authors' point of view, investments in these areas are therefore sensible and quickly profitable. At present, however, companies are still cautious about investing in digital transformation, as investments generally require a certain amount of time to generate a return and still always entail a certain degree of uncertainty. Customer satisfaction is usually assessed in terms of product satisfaction, accessibility, connectivity and simplicity, as well as cost and delivery capability. It should also be noted that it is precisely the power of consumers and customers that is strongest, as they ultimately have the power to decide whether or not to buy a vehicle or product. For consumers, the high vehicle costs, long charging times, the short vehicle range and the scarcity of charging stations continue to be the main obstacles to buying a hybrid or electric car. Improvements in these aspects as well as additional lower energy costs, emissions, higher energy efficiency, low repair and maintenance costs and special parking spaces as well as tax incentives can be aspects that significantly improve consumer interest in electric cars. At present, there are still competing interests among stakeholders, which is why the introduction of electric cars has been slow (Llopis-Albert et al., 2021).

Digital transformation also focuses primarily on increased customer benefit, whereby digital business models are also intended to create great value for companies. In turn, digital transformation also helps to link customer requirements with the

relevant specialist knowledge and empirical findings. This allows business models to be aligned even more precisely with the respective needs and market requirements (Lee et al., 2021).

Overall, the following aspects continue to have a strong impact on the automotive industry and will continue to do so in the future, thus encouraging the industry to focus more strongly on the Green Deal and its own environmental responsibility. These include, among others: Exponential population growth, new markets and new consumers and also presumably the further increase in prosperity in the form of more cars per capita (Schönmayr, 2017).

Up to this point, many aspects of the Green Deal have already been mentioned and discussed. The question now arises as to what exactly the connection between smart mobility and the Green Deal is. It can be assumed that the precise measurement of climate change and the concrete evaluation of weather data has only become possible thanks to digitalization and the associated measures. As a logical consequence, the approaches of the Green Deal have also emerged. The challenges currently facing mobility have already been mentioned. The smart mobility approach then opens up the corresponding potential uses for overcoming the challenges of mobility accordingly.

2.2 Smart Mobility

The term "smart mobility" covers several areas of modern mobility, some of which are referred to by different names. Smart mobility is referred to as intelligent mobility, mobility-as-a-service or mobility 4.0 and is also understood as autonomous driving or intermodal traffic management. The main objective of smart mobility is to provide efficient, cost-effective, safe and environmentally friendly mobility for people and goods. Smart mobility is also evaluated differently depending on the region, as the mobility requirements in rural regions are already different from those in urban centers of life. In times of rapid development of megacities with 10 million inhabitants and more, smart mobility developments have focused primarily on these. However, it is just as important to consider normal cities with regular populations as well as rural areas. In her work, Flügge raises the question of who can still rely on a mobility service at all in times of car sharing, electromobility and autonomous driving with a simultaneous scarcity of resources and outdated and high-maintenance infrastructure (Flügge, 2017). However, the current situation is such that there is an increasing problem between the desire for individual and optimal mobility and the structural and industrial weaknesses of the mobility system. In some areas, there is already talk of the system being overstretched (Flügge, 2020). Mobility is a fundamental human need that enables both contact between people and the exchange of goods. However, increasing mobility comes at an ever higher price for people and, above all, the environment. The boundaries between private and public transport will become increasingly blurred. Examples of smart mobility include automated parking, automated logistics, the autonomous last mile to the end customer, digital and connected connectivity solutions as well as digital real-time maps. In a broader sense, the connections between vehicles, people, traffic control in the form of traffic lights etc. and other mobility services are also absolutely essential. The technical infrastructure is always the basis for modern smart mobility (Baumann, Püschner, 2017). Sensor technology will make a decisive contribution to success, particularly in the areas of smart mobility mentioned above, whereby the focus is always on putting people at the center of interaction (Orecchini et al., 2019).

Various usage scenarios arise in the area of the mobility-as-a-service approach. Possible providers for this are, in particular, large automotive groups as well as public or municipal mobility providers. However, some stakeholders are currently asking themselves whether there really is a large market for this mobility service. The current literature suggests that urban and digitally savvy people in particular are more willing to use such a pure mobility service. However, the services must then be

offered individually and tailored to user behavior and not as a package. However, MaaS needs to be more closely integrated into multimodal transport in order to be accepted by travelers and thus bring about a change in users' travel behavior (Karlsson, 2020).

Smart mobility could become very interesting, especially for the use of the last few meters to the destination in urban areas. Experts assume that self-driving cabs could only account for around a third of current cab costs. In their analysis, Vogel et al. come to the conclusion that the success of smart mobility depends heavily on user acceptance, which has already been mentioned several times before. A large part of the necessary transport infrastructure for sustainable smart mobility is still missing in today's inner cities. Above all, a very good infrastructure network is required to implement this. E-mobility, connectivity, mobility apps and artificial intelligence can help to significantly reduce noise and emissions locally. Piloted parking must be taken into account, as must fast lanes in the city center. Recent studies also assume that the focus of cities on cars as the main means of mobility will decline. In times of smart mobility, reward approaches and additional parking spaces for shared vehicles are also a way of making car sharing and resource conservation more attractive, and policy-makers in particular can continue to exert a strong influence on this (Vogel et al., 2018). Especially in areas where there is a high proportion of commuters, construction sites or various other mobility services such as airports, it is important to look for an adaptable strategy. Flügge therefore defines the concept of smart mobility as follows: as visionary but feasible mobility of the future. This must be applicable and usable for everyone, regardless of location and region, regardless of duration and scope of use, individual budget and abilities (Flügge, 2017). This definition can also be continued in the context of this work.

The main criticism of the current transport situation to date is that mobility has so far been thought of in silos, i.e. according to individual mobility fields such as automobility, local public transport, train travel or air travel. The second division was into private and public mobility providers or passenger and freight transport (Flügge, 2017).

When considering smart mobility in the automotive sector, however, it is first necessary to consider the car as such. Car-based systems have brought with them a high degree of accessibility, connectivity and convenience. The disadvantages of the car, on the other hand, are noise, pollution, significant land consumption, urban sprawl, urban decay and even severe isolation in some areas. At present, the car is still the main means of transportation in Europe. Freedom, prosperity and quality of life are the key benefits of the car, which in turn are offset by health problems, global warming and inefficient resource management. This is also the conclusion of the Urry study from 2004 and 2008 (Kauschke, 2023). The car is increasingly competing with other means of transportation and is increasingly seen as inefficient mobility. Smart mobility also pursues the goal of improving mobility between goods and people around the world (Flügge, 2017b). According to Flügge, the optimal mobility outcome is primarily dependent on the variables of time, budget and comfort.

At this point, the most relevant aspects that can be optimized accordingly with smart mobility must be mentioned in relation to the automobile. These include opportunity costs for all types of travel planning, heavily congested infrastructure such as roads and the like, a further increase in global freight traffic, limited space capacities, a low number of car uses due to predominantly idle times, a further increase in the global population, increased population growth, urbanization, the spread of networked systems and the increase in smart cities and autonomous cars. Urban centers in particular will become increasingly in demand, with around 50% of the world's population already living in cities. Urban planning in the sense of smart cities in combination with smart mobility is therefore becoming increasingly important (Khashoggi, Mohammed, 2023). The unequal access to mobility in both rural and urban areas will certainly also be a

problem here (Flügge, 2017b). In regions where new cities are built from scratch and start from scratch, it is much easier to incorporate smart mobility solutions. As a rule, new design concepts and technologies are directly integrated there in order to implement the smart city concept accordingly. Existing cities face significantly greater challenges, as it is not easy to simply relocate roads, train tracks or subway networks (Flügge, 2017b).

In the further course, it is particularly important to work out what the specific differences will be in relation to smart mobility in the field of automobility. A number of aspects are repeatedly highlighted in different literature. From the authors' point of view, it can be assumed that car manufacturers will tend to become mobility providers in the future and put together corresponding mobility packages. The business model will tend towards a constant cash flow and away from the margin on every car sold. Public and state mobility providers will also have to revise their infrastructure and products. However, new trains and new tracks are still a long way from true digitalization. So far, digitalization has tended to take place in order to save costs and personnel, which includes the installation of ticket machines. At the same time, the specific mobility requirements of the population continue to be forgotten (Flügge, 2017c). Autonomous shuttles and multimodal transport services in combination with alternative drive systems will change the transportation sector. Baumann and Püschner assume that the boundaries between public and private transportation will blur or disappear. Innovative business models will be able to play a pioneering role here (Baumann, Püschner, 2017).

From the perspective of smart mobility in the automotive sector, the following use cases arise: smart parking in combination with autonomous public transport shuttles; smart mobility for optimized and intermodal route guidance in the transport sector; smart delivery of parcels over the last kilometer; digital route guidance for navigation users; smart communication between vehicles and traffic lights as well as public transport; optimized traffic flow; simplified travel for companies; car sharing; shared travel routes; autonomous driving (Flügge, 2017d). The availability of different mobility options is determined by the decisions of users and local providers. At the same time, the number of rules and signs in urban areas is also increasing, making it more difficult for drivers to cope (Böhm et al., 2020).

Further analysis also reveals other measures and ideas. The concept of smart mobility in combination with the Green Deal, or rather in combination with environmental protection and sustainability, is currently still a very new discussion in literature and science. It should also be noted that smart mobility is one of the six design elements of the smart city. The term Smart City is also characterized by the five elements Smart Governance, Smart People, Smart Living, Smart Economy and Smart Environment (Flügge, 2020). The terms smart city and smart mobility go hand in hand in some areas, with smart mobility benefiting greatly from smart city developments in some areas. Cities are increasingly starting to install intelligent sensor data in order to better regulate parking spaces and traffic. This data is then in turn fed into cars. At the same time, many new mobility providers, such as e-scooters and the like, have moved into cities (Nienaber et al., 2020). Cities are important for the economic upturn, as they bring together economic performance and other areas in a small space and can therefore develop a high level of strength (Gidebo, Szpytko, 2020).

However, the current situation is such that there is an increasing problem between the desire for individual and optimal mobility and the structural and industrial weaknesses of the mobility system. In some areas, there is already talk of the system being overstretched (Flügge, 2020).

Search queries for the term smart mobility have been on the rise for years and have roughly tripled over the past ten years. Interest in smart mobility is also growing in research. The definition of smart mobility is not clear in the industry. In consulting, the term revolution has been coined for this. In this context, smart mobility refers to the use of means of

transportation in addition to or instead of owning a fossil-fuelled vehicle. In their definition from 2020, Ahmed et al. go further and describe the intelligence of the system's self-learning capabilities as the decisive criterion. Intelligent mobility thus primarily stands for efficient and convenient travel with a minimum of human intervention. In 2016, Mueller-Seitz et al. defined smart mobility as encompassing performance dimensions such as sustainable, innovative and safe transportation systems. Flügge already defined the numerous target dimensions of smart mobility more comprehensively in 2016. Flügge defines smart mobility as a service that enables energy-efficient, low-emission, safe, comfortable and cost-effective mobility and is used intelligently by road users. The aforementioned definition by Flügge from 2017 can therefore be supplemented with the approaches from 2016 from today's perspective. Other authors tend to separate smart mobility from the idea of sustainability in their definitions. In 2017, Jeekel defined this as user-oriented, technology-oriented, IT-oriented, development-oriented and action-oriented. Lyons stated in 2018 that smart mobility evokes a sense of new possibilities and progress. In Lyons' view, smart mobility broadens horizons and must also include sustainable mobility and liveable mobility spaces. According to Anders and Klaassen's text mining approach from 2018, smart mobility focuses on optimization rather than challenging the status quo. Based on the findings of the various authors up to this point, it is also necessary to include social and sustainability-related objectives in smart mobility (Kauschke, 2023).

Of particular interest are the findings of some studies that attribute a reduction of up to 50% to the aspects of smart mobility with regard to the potential for reducing emissions. These are the findings of the studies by Barth et al. from 2015, Jochem et al. from 2015 and Pribyl et al. from 2020. Kauschke therefore summarizes the various definitions mentioned above and redefines the term smart mobility himself, whereby in his opinion smart mobility stands for a smooth future of ubiquitous and networked transport, i.e. for an effective system that is optimized for sustainability, attractiveness and affordability and goes hand in hand with the introduction of automated and electrified vehicle systems. Kauschke also considers the environmental challenges and quality of life as well as the aspects of electrification, automation and the main goal of digitalization in the area of process optimization (Kauschke, 2023).

Bereits zuvor war kurz auf die Nutzerakzeptanz eingegangen been developed. At present, smart mobility still faces the challenge of generating greater user acceptance. As Whittle et al. showed in their 2019 analysis, user interests have not yet been sufficiently taken into account in the planning of smart mobility. Drivers' usage behavior must therefore change so that drivers in particular are willing to switch to different modes of transport. Confidence in the new smart mobility must increase and the range of services must improve in order to make the switch. Mulley and Kronsell also addressed this in their 2018 study. The necessary aspects that need to be taken into account for smart mobility include flexible and short-term availability, a competitive price, the same speed as by car and a service with easy access options. Service providers and mobility providers need to work more closely together. It is important that the offers are passed on to customers and users via many different providers so that users have a good chance of using many offers, which in turn increases speed and availability. The next mobility system must be developed in such a way that it appears attractive to the user (Kauschke, 2023).

In his analysis, Kauschke also comes to the conclusion that personal mobility behavior, modernity, experience with the new mobility and preferences for certain vehicle models as well as personal attitudes towards political interventions are decisive factors when it comes to electromobility. Understanding how autonomous systems can offer added value to society is particularly important for user interest in autonomous driving systems. This must be explained to customers. Furthermore, reliability, trust and confidence are the relevant components for

the future reputation of automated mobility (Kauschke, 2023). In his study, Kauschke also comes to the conclusion that smart mobility is similar to mobility-as-a-service (MaaS). The advantages of location and time independence are particularly emphasized in modern systems.

In his study, Kauschke comes to the conclusion that smart mobility is less widely accepted by users than electromobility, but that acceptance is higher than for hydrogen vehicles. The respondents in this study consider smart mobility to be compatible with their lives, easy to use and efficient. Convenience, flexibility and safety are the main drivers for the performance rating. In Kauschke's 2023 study, however, only around 20% of respondents use smart mobility solutions more than once a week. However, a study by Fleury et al. from 2017 came to the conclusion that smart mobility is not perceived as something commonplace because it is expensive and socially unjust. Significantly more complex acceptance components can be derived from this. According to Kauschke's analysis, user acceptance depends on the factors of performance expectation, facilitating conditions, social influence, habit and hedonic motivation. Broader acceptance of smart mobility could therefore be achieved through the participation of users and citizens (Kauschke, 2023).

In weiteren Aspekten sollten auch die Ideen hinsichtlich of modern mobility hubs. These hubs can be central contact points for different modes of transport. Especially the changes in city centers with increasing vacancies could also be an approach for such modern transport hubs or parking centers (Hachette, L'Hostis, 2024). The increase in bicycles and other sustainable forms of mobility must also be taken into account in smart mobility approaches (Dylan, 2024).

In another study, Bellotti et al. come to the conclusion that smart mobility should also take into account the aspects of modern mobility platforms in order to have an optimal effect. Ecologically correct behaviour could be optimized through incentives or rewards from providers, service providers, authorities or insurance companies. Seamlessly expandable apps and ecosystems with suitable platforms could be the right approach here. Modern mobility systems therefore increasingly require a modern platform or their own ecosystem. The approach that collaborative mobility and smart mobility generally go hand in hand with ecologically positive mobility and therefore require a suitable ecosystem should be particularly emphasized here (Bellotti et al., 2016).

It is still questionable to what extent smart mobility should be implemented. However, further research into the literature has revealed various possibilities for use. This starts with the type of means of transportation, the combination of several people for one means of transportation, intelligent parking and traffic light control, sharing economy, sustainable drive ideas, etc. (Alba et al., 2016).

Back in 2013, Burkert came to the conclusion that the future of driving will be emission-free and connected. It is precisely this approach that this study takes up and essentially comes to the same conclusions. The combination of smart mobility and sustainability is primarily about leaving a minimal CO2 footprint in the scarce and precious space of city centers. However, Burkert also pointed out back in 2013 that the aim must be to create a form of mobility that is fully accepted by customers. The need for new mobility services and different vehicles will therefore continue to increase (Burkert, 2013).

It can therefore be seen that there is currently no specific study in the literature on the effects of the Green Deal on smart mobility. However, smart mobility is generally always associated with compensating for the disadvantages of existing forms of mobility and aims to achieve this through digital processes. Almost all studies also focus on the goal of sustainability as one of the main objectives of smart mobility.

3 Methodology and Data

The aim of the article is to use a systematic literature analysis and an online survey to work out the impact of the Green Deal on the field of smart mobility. This was answered in the form of closed questions in an online survey. A specific target group was not selected for the online survey. However, the participants were to be automotive customers or potential automotive customers and aged between 18 and 70. There were no people outside this age corridor in the survey. The primary interest of the work was to evaluate the interests and opinions of consumers in relation to the Green Deal and Smart Mobility. The questionnaire was initially structured with an indication that the survey was anonymous and that all relevant data protection regulations would be observed. The first two questions asked whether the respondents were aware of the contents of the Green Deal and Smart Mobility. On a subsequent information page, the respondents were given an explanation of what the Green Deal and Smart Mobility are, so that they had a uniform level of knowledge for the subsequent answers to the questions. Respondents were approached both in person and via online message. The survey was conducted in October and November 2023. For the analysis, mainly questions in the agreement range 1 (no agreement) to 5 (full agreement) were selected. The results are statistically analyzed below. Both linear and multiple linear regressions are carried out. The analysis was carried out using the statistics program R. To ensure reliable and valid data collection, the questionnaire followed a standardized pattern based on established scientific measurement instruments. Participants were randomly selected from a representative sample of (potential) automotive customers. Demographic characteristics such as age, gender and geographical location were also taken into account to ensure reasonable diversity within the respondents. The survey was conducted within the months of October and November 2023 to ensure that it was up to date.

The survey also complied with ethical standards. The participants were informed about the anonymity of the data, the voluntary nature and the purpose of the survey. This meant that there were no risks of data exposure and the data was stored in the empirio program used to conduct the survey.

There were no conflicts of interest, as the survey was conducted in an unbiased and impartial manner. This ensures the integrity and credibility of the results. The participants' data is respected and participants have the option of withdrawing from the survey at any time.

In order to enable a statistical analysis, the questions were structured as consent questions. The aforementioned research question is to be answered with the help of the following hypotheses. The following hypotheses result from the literature analysis carried out up to this point:

H1: The more familiar respondents are with the content of the Green Deal, the more familiar they are with the content of Smart Mobility.

H2: The more respondents are aware of the Green Deal, the more willing they are to use smart and sustainable mobility.

H3: The more respondents see the Green Deal as a measure to support environmental protection in sustainable mobility, the more likely they are to use multimodal mobility as part of smart mobility.

H4: The stronger perception of environmental goals or the Green Deal has a significant positive correlation with the more frequent choice of environmentally friendly means of transport.

H5: Stronger agreement with the objectives of the Green Deal correlates positively and significantly with preferences for sustainable mobility.

H6: The more likely respondents are to use conventional means of transport, the stronger the positive correlation with the expectation that car manufacturers will implement the Green Deal.

H7: A higher income correlates positively and significantly with a stronger preference for sustainable lifestyles and mobility solutions.

In the following chapter, the statistical evaluations of the hypotheses are carried out.

4 Results and discussion

Hypothesis 1 arose from the literature research and assumes that greater knowledge in the area of the Green Deal and environmental protection will also lead to greater interest in the field of smart mobility. It can therefore be assumed that the Green Deal generally has a positive effect on the development of smart mobility.

H1: ACCEPTANCE

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)      3.03861    0.15619  19.455 < 2e-16 ***
AgreeIno5yesGDwellknown 0.27799    0.05765   4.822 3.08e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.8392 on 174 degrees of freedom
Multiple R-squared:  0.1179, Adjusted R-squared:  0.1128
F-statistic: 23.25 on 1 and 174 DF, p-value: 3.082e-06
```

The P-value below 0.05 indicates that H1 can be assumed and that there is a correlation. The result makes it clear that there is a highly significant correlation between respondents' knowledge of the Green Deal and smart mobility. This also means that an increase in interest in the Green Deal leads to an increase in interest in and use of smart mobility. The multiple R-squared or the adjusted R-squared explains 11.79% of the variance of the dependent variables. It can therefore be concluded that only around 12% of the respondents' knowledge of smart mobility can be explained by their knowledge of the Green Deal. A 100% would be a perfect explanation.

Compared to hypothesis 1, hypothesis 2 assumes that an increase in knowledge about the Green Deal also leads to a higher use of smart mobility. This hypothesis must be rejected based on the available data, as the P value is over 17%. The model provides no explanatory contribution, so it can be assumed that there is no correlation.

H2: REJECTION

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)      3.50970    0.17306  20.280 <2e-16 ***
AgreeIno5yesIoftenuseSM 0.07479    0.05485   1.364  0.174
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.8888 on 174 degrees of freedom
Multiple R-squared:  0.01057, Adjusted R-squared:  0.004886
F-statistic: 1.859 on 1 and 174 DF, p-value: 0.1745
```

Hypothesis 3 assumes that the Green Deal actively contributes to environmental protection and that this is accompanied by a higher use of sustainable mobility. If respondents see the Green Deal as an opportunity for sustainable mobility, the more willing they are to use multimodal mobility, i.e. a combination of different mobility options.

H3: ACCEPTANCE

```

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    1.47655    0.36781    4.014 8.84e-05 ***
AgreeIno5yesG0pushessustainablemobility 0.51919    0.09878    5.256 4.28e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.29 on 174 degrees of freedom
Multiple R-squared:  0.137, Adjusted R-squared:  0.132
F-statistic: 27.62 on 1 and 174 DF, p-value: 4.275e-07

```

The available data confirms the assumption of this hypothesis. According to this, a higher understanding of the Green Deal as an environmental protection option among respondents also leads to a higher acceptance of the use of multimodal mobility. The model delivers a highly significant result.

Hypothesis H4 showed that a higher perception of the environmental goals of the Green Deal also leads to a greater choice of sustainable means of transport. This finding emerged from existing studies as part of the literature review.

H4: ACCEPTANCE

```

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    1.61514    0.33513    4.819 3.12e-06 ***
AgreeIno5yesG0pushessustainablemobility 0.36034    0.09001    4.004 9.23e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.175 on 174 degrees of freedom
Multiple R-squared:  0.08435, Adjusted R-squared:  0.07908
F-statistic: 16.03 on 1 and 174 DF, p-value: 9.227e-05

```

The statistical analysis confirmed hypothesis 4 with a highly significant result.

Hypothesis 5 is based on a similar approach to hypothesis 4. Hypothesis 5 can also be confirmed in this context.

H5: ACCEPTANCE

```

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    0.64088    0.21465    2.986 0.00324 **
AgreeIno5yesSustainablelifestyleisimportantforme 0.78882    0.06336   12.450 < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.8039 on 174 degrees of freedom
Multiple R-squared:  0.4711, Adjusted R-squared:  0.4681
F-statistic: 155 on 1 and 174 DF, p-value: < 2.2e-16

```

The result for hypothesis 5 is also highly significant.

Hypothesis 6 assumes a somewhat inverse relationship. It can be assumed that if customers make greater use of conventional and generally more environmentally harmful means of transport such as cars, they will expect customers to see car manufacturers as having a duty to meet the requirements of the Green Deal.

H6: ACCEPTANCE

```

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    4.39071    0.34702   12.65 <2e-16 ***
AgreeIno5yesImostlyusecar -0.19660    0.08226   -2.39  0.0179 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.218 on 174 degrees of freedom
Multiple R-squared:  0.03178, Adjusted R-squared:  0.02622
F-statistic: 5.712 on 1 and 174 DF, p-value: 0.01792

```

Hypothesis 6 can be confirmed, although the result is not high, but only significant.

Hypothesis 7 most recently referred to income and assumed that a higher income also correlates with a greater interest in sustainability, environmental protection and sustainable mobility. This cannot be confirmed in the survey, as the P value is significantly higher than 0.05.

H7: REJECTION

```

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  3.332e+00  1.171e-01  28.460 <2e-16 ***
income      -3.006e-05  3.362e-05  -0.894  0.372
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.9597 on 174 degrees of freedom
Multiple R-squared:  0.004575, Adjusted R-squared: -0.001146
F-statistic: 0.7997 on 1 and 174 DF, p-value: 0.3724

```

The model does not provide an explanation for the hypothesis.

The individual study models all have relatively low coefficients of determination R-squared. The goodness of fit of the regression is therefore predominantly relatively low, which means that the proven correlations exist, but that other independent variables are responsible for explaining the dependent variable in the individual hypotheses.

This study provides a comprehensive insight into the link between the Green Deal and smart mobility. However, despite clear conclusions and identified links, there are several critical aspects that should be considered.

Firstly, the low awareness of the Green Deal among only about a quarter of respondents shows that public education and communication of this policy instrument is insufficient. This raises questions about the effectiveness of environmental protection measures if the population is not sufficiently informed. A more in-depth analysis of the educational levels and demographic characteristics of the uninformed could provide additional insights.

Secondly, the survey results reveal that despite some knowledge of the Green Deal, the willingness to use smart mobility is not necessarily increasing. This raises the question of whether the policy objectives of the Green Deal are sufficiently aligned with the individual needs and preferences of the population. A detailed analysis of the heterogeneity of response patterns could identify possible segments that need specific incentives.

Thirdly, the results emphasize the continued dominance of the car as the main mode of transport, despite increasing environmental awareness. This raises the question of the actual barriers to wider adoption of sustainable mobility solutions. A closer examination of the perceived barriers could help to develop more practical solutions.

Finally, the emphasis on multimodal mobility networks and the need to collaborate across sectors points to potential complexities and conflicts of interest. A critical analysis of the interests of the stakeholders involved, particularly the automotive industry, could reveal whether their motivation is in line with the environmentally friendly goals of the Green Deal or is based more on self-interest.

Overall, the study provides important insights, but emphasizes the need for in-depth critical reflection in order to ensure the sustainable implementation of the Green Deal in the field of smart mobility.

5 Conclusion

Overall, the study comes to clear and comprehensive conclusions. The impact of the Green Deal on intelligent, smart mobility is definitive. It is clear that the Green Deal and smart mobility are closely linked and have a certain interdependence. The Green Deal will probably not be feasible without the smart mobility approaches. The findings of the literature research have also shown that smart mobility goes far beyond the approaches of intelligent mobility and is often linked to the idea of sustainability.

Furthermore, the Green Deal approaches cannot simply be replaced by electromobility. Rather, a comprehensive, interlocking multimodal mobility network is needed for the future.

From a smart mobility perspective, it can be assumed that the Green Deal will continue to have a strong influence on smart mobility factors. This includes the promotion of sustainable mobility, technical innovations and a multimodal mobility concept. At the same time, the Green Deal will also change the fundamental environmental understanding of mobility. Regulatory standards have already been raised by politicians and, as already agreed, will continue to rise as part of the Green Deal. The automotive industry must therefore implement the Green Deal through smart mobility approaches.

The results of the survey also show a clear picture, although there is still room for future research in some areas. Overall, the survey results come to the conclusion that it will definitely be necessary to educate the population even more about the Green Deal and the aspects of environmental protection. In the survey, only around ¼ of respondents stated that they were aware of the content of the Green Deal. From the perspective of the survey, it can therefore currently be assumed that the Green Deal is more of a political issue that has not yet been fully understood and communicated by the population. However, even knowledge of the Green Deal does not lead to direct use of smart mobility. This study comes to the conclusion that it is necessary to communicate the contents of the Green Deal even better so that customers better understand the advantages of the Green Deal and the ideas for environmental protection. However, realistic implementation will only be possible if sensible multimodal mobility concepts are also implemented. The Green Deal must be understood as an opportunity to protect the environment. In addition, there must be a stronger commitment to the goals of environmental protection and the Green Deal so that customers are also prepared to make their mobility sustainable. Around 86% of respondents also stated that they still predominantly use the car as a means of transportation. However, the analysis also confirmed that it is precisely these customers who expect car manufacturers to implement the Green Deal. This results in a great responsibility for car manufacturers in particular. However, the findings from the literature research have also made it clear that a pure shift to electromobility is not the absolute approach. From the perspective of this thesis, it will be much more necessary for companies from various sectors, including airplane providers, rail companies, regional transport companies and new mobility providers such as scooter providers, to join forces with car manufacturers in order to develop joint ecosystems and software platforms to create a multimodal transport system that combines the advantages of all mobility systems. Above all, customers need a simple solution. Approaches here could include longer distances by train and the last mile with self-driving cars, rental cars or car-sharing vehicles. It is also relevant to note that the literature research has shown that people with higher incomes in particular are more likely to be able to afford sustainable solutions, as these are often still expensive. However, the study comes to the conclusion that interest in sustainable mobility solutions does not increase as income rises. It would therefore be even more important to develop cheaper, more sustainable solutions.

There is therefore no question that the Green Deal is having an impact. Customers understand the Green Deal and also see the connection with sustainable and smart mobility. However, there are currently still too few customers. Above all, it will be necessary to further intensify the understanding of the Green Deal and sustainable mobility and to offer solutions for all income levels across all forms of mobility. Car manufacturers in particular have a duty to do this. Simply switching to electromobility will not be the only solution and will not fulfill the aspects of smart mobility under the aspect of the Green Deal.

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DEMAND FUNCTION OF COFFEE

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Abstract: The aim of the paper was to investigate the demand function for coffee in selected EU countries using content analysis, price elasticity and income elasticity calculations. The content analysis revealed 13 factors behind the demand for coffee, including quality, rare, healthy, unique and certified coffee, eco-labels, decaffeinated products, sensory and physiological characteristics, human diseases and environmental pollution as the main determinants. The relationship between the demand for coffee and its price was also examined, measuring price and income elasticities of demand. The factors behind coffee demand have created a perfectly inelastic demand in the EU. Low quality coffee is not attractive to consumers who want excellent, rare and healthy products. It is therefore concluded that there is a perfectly inelastic demand for coffee. The quantity demanded is independent of changes in coffee prices, indicating that the quantity demanded does not change despite price fluctuations (no elasticity). Coffee is classified as an inferior commodity in the EU and shows declining demand despite rising incomes.

Keywords: coffee, income elasticity, price elasticity, European Union.

1 Introduction

Coffee is an essential agricultural commodity, kick-starting the economy of many coffee-producing countries (Krishnan et al., 2021). This popular beverage, massively drunk from time immemorial, ranks second among marketable commodities, losing only to oil (Sengupta et al., 2020). Coffee globally grows in importance, as it boosts the economy and gross national product, including developing and less-developed countries (Al-Abdulkader et al., 2018). The increased demand for coffee pulls businessmen and producers when consumers are willing to pay more for a certified product (Wahyudi et al., 2020). The coffee industry is integral to global economies, where developing countries involve 90% of the world's production, supporting about 25 million small farmers (Garcia-Freites et al., 2020). We globally produce over 9.5 billion kg of coffee, and expecting a tripled demand by 2050 (Nab and Maslin, 2020).

Indonesia ranks second behind Brazil, Vietnam and Columbia in global coffee production (Fortunika et al., 2021), generating incomes for local coffee growers, industrial producers, and coffee processing entrepreneurs and encouraging import and export (Prabowo et al., 2021). The coffee supply varies depending on many factors, including coffee quality or production efficiency. Inelastic supply and demand may cause violent fluctuations in the market price (Kuswardhani a Yulian, 2019). Tuyenh et al., 2020 indicate Robusta Coffee as the closest variable influencing the export price of Vietnamese coffee. The estimated variance suggests that a decline in global coffee prices during the financial crisis led to increased school dropout rates of children between 15 and 18 in coffee-producing villages. The effect spreads mainly among this age group (Asfaw, 2018). The essential determinants of coffee production involve nitrogen levels in soil, soil pH, solar radiation, illness and weed rates (Notaro et al., 2022).

Variables related to global macroeconomic and financial development are instrumental in explaining the historical trend in coffee prices and making accurate predictions outside the sample (Crespo Cuaresma et al., 2018). They detected higher prices in organic coffee cherries but, according to Fairtrade, lower average values in other non-certified buyers (Valenciano-Salazar et al., 2022). Chemically-related varieties have similar prices and are more likely to strengthen long-term relationships and adapt to price shocks (Otero et al., 2018). The observed price asymmetry may reflect too much involvement of the coffee supply chain in coffee roasting, where coffee roasting plants receive larger profit shares (Ghoshray and Mohan, 2021). Narcis (2020) suggests an increased likelihood of migration of low-educated people, pointing to marked price inversions. The author

blames these outcomes on uninformed producers, well-informed agents and conspicuous consumers in highly unreliable auction markets (Marcus et al., 2022).

Marketing managers promoting fair trade in developing markets should devise effective promotion strategies, using psychological factors to influence consumers to pay for Fair Trade products (Lappeman et al., 2019). Grant and Palakshappa (2018) show how corporate social responsibility affects mainstreaming fair-trade processes, although push-pull strategies change with circumstances and interpretation. Retailers in a local specialized coffee market stimulate creativity, cultural identity and innovation to make their products unique, unwilling to pay a premium for these attributes. Consumers favour a unique café style and product cover (Wann et al., 2018). Systems of sustainability certifications, including FAIRTRADE, FLO, WFTO, and FT-USA, cornered thriving markets (Ribeiro-Duthie et al., 2021). Ardent premium Fair Trade and organic coffee consumers of inelastic demand likely turned to conventional coffee rather than regular Fair Trade and organic coffee. Yet, both alternatives were equally cheap (Lee and Bateman, 2021). We need relevant indicators of coffee sustainability for all players in the value chain. These signals must comply with sustainable development, including transparency and a coherent framework for reporting (Bager and Lambin, 2020).

2 Literary research

Lee and Jeong (2022) suggest a method for predicting coffee grain defects by applying a CNN model to classify binary pictures with 90.44% accuracy. Sunarharum et al. (2018) measured how various post-harvest processing methods affect the physical and sensory quality of Java Arabica green coffee grains. Their findings showed fewer defects in wet-processed coffee than in grains treated in dry conditions. Wang et al. (2021) used the nonlinear grey Bernoulli model based on a parameter-optimization algorithm to make more accurate predictions for demand volatility and uncertainty of coffee grain volumes and prices. They integrated the model with Fourier series of residual modifications to forecast coffee grain prices, exploring the system of the Vietnamese supply chain of coffee grains. The authors used a differential equation of this uncertain system with existing data for the last six years to calculate the coffee grain price.

Atmadji et al. (2018) compared Indonesian and Vietnamese coffee by the demand function, including time series, a cointegration test based on the Bound Tests in the ARDL method. While Malaysians cointegrated their demand for Indonesian coffee, they did not stimulate cointegration regarding Vietnamese products. It means that Vietnamese coffee cannot compare to the Indonesian product in the Malaysian market. Permany et al. (2020) argue that farmers who know about effective marketing channels use the best pathway to get a more reasonable selling price. The authors combined surveys with qualitative and quantitative descriptive analysis. They discovered four marketing Arabica coffee channels, indicating the coffee Arabica Channel I as the geographically most effective label.

Otero et al. (2018) used time series and cross-sectional studies to explore long-term relationships between pairs of coffee prices, assessing chemical, institutional and market factors behind the likelihood of detecting stationary price differences. Using an empirical approach, they found that chemically-related varieties have similar prices, maintain steadier relationships, and better adapt to market shocks. Milijkovic et al. (2019) used the Alchian-Allen theorem to explore a relative demand for three quality-different coffee varieties globally sold, revealing that the Common unit price increases coffee quality. Abaido and Agyapong (2022) measured the impact of price movements of commodities (oil, cocoa, coffee, cotton and gold) in the international market on developing economies in Sub-Saharan Africa. Empirical estimates for theoretical relationships are

based on a two-step method of moments, indicating that oil, cocoa and gold per cent inflation in the global market under the same conditions significantly rewards subregions. Strangely enough, the same price changes in cotton and coffee harmed the subregional development.

Fortunika et al. (2021) used a Linear Approximate-Almost Ideal Demand System to analyze the market position of Indonesian coffee and its competitors. They revealed that most slope coefficients were statistically significant and complied with the microeconomic theory, where trade policy variables hugely swayed the Indonesian coffee business. Hakim et al. (2020) tried to increase the added value and profits for small plantations and companies using system dynamics. This methodology involves a modelling technique of system thinking, including feedback loops and time delays, to understand complex dynamics and behaviour of physical, biological and social systems. Scenarios I and II involved changes in model parameters leading to increased business profits in companies, whereas small plantations did not see any growth in earnings. Neto and Robles (2019) used a direct calculation to analyze data on Arabica coffee production. This documentary, descriptive and qualitative research method showed a margin of 61% and an amount produced exceeding the return rates, indicating positive outcomes. This above-average income resulted from the clever use of information from direct costing when managers can optimize the production process, increase the profit margin and ensure business growth and development.

Milani et al. (2020) revealed that some coffee producers add cheap materials (corn, barley or even coffee pods) to commercial coffee to maximize profits. The estimated correlation coefficients involved highly correlated current and future coffee prices. The regression coefficients disclosed a strong relationship between the current and future outputs in all four ICO indicators. The ICE New York (Arabica) and ICE Europe (Robusta) future prices closely relate to current prices. Although the estimated regression coefficients between eventual values and money paid to coffee growers in India indicate a positive relationship, the values scattered around the trend line show a weaker correlation between the money paid to Indian cultivators and the future market price over the monitored period (Babu, 2020). Value generators in the chain comply with production processes aiming to produce excellent coffee grains and provide an exhilarating experience. The study reflects a content analysis of reports gathered from two Brazilian journals over one and a half years (Boaventura et al., 2018).

Durevall (2018) estimated a long-term product share transfer, using regression analysis to explore how the share transfer differs through the market, retailer-owned labels and other product traits in Swedish data on coffee products. He revealed a massive product transfer with large market shares, while transfer rates in goods with modest market shares were low. Vilela and Penedo (2021) applied a multiple linear regression for panel data, using a price paid to the producer for an Arabica coffee bag from 2007 to 2018. The authors used the Kruskal-Wallis test to identify possible relationships between cost variables and the producer's region. The results indicate a negative correlation between the costs of machines, pesticides, production volumes and coffee price fluctuations, whereas taxes demonstrate a positive relationship with coffee price variations. The producer's region significantly correlates with price changes, as productivity, pesticide costs, workforce and machine rates spread among the provinces.

Kittichotsawat et al. (2022) explored Arabica coffee yields corresponding to the market demand using artificial neural networks (ANN) and multiple linear regression (MLR). Six-variable data involving regions, production zones, precipitations, relative humidity and minimum and maximum temperature covered 180 months between 2004 and 2018. The authors revealed that the prediction accuracy of R² and RMSE from ANN was 0.9524 and 0.0784 t. The ANN model showed potential when measuring yields of Cherry coffee. Handino et al. (2019) mapped the position of small Ethiopian coffee producers

who sell the beverage through certified associations. Although the findings indicate better average prices for members of the associations, there is no evidence that higher prices reflect increased household incomes.

The last 20 years have seen a growing demand for coffee (Ruiz et al., 2021), especially for quality and certified coffee varieties (Wahyudi et al., 2020). Global predictions expect an increase in the demand for Arabica and Robusta shortly. Without extra investments in research, we will not be able to meet the rising demand, as climate change gives rise to pests and plant pathogens that hinder productivity (Krishnan et al., 2021). Unusual coffee types (civet coffee) are the most expensive. Its uniqueness and rarity boosted the consumer demand for the product (Raveendran and Murthy, 2022). Gatti et al., 2022 proved that ecolabels could appeal to the tastes of consumers who prefer pesticide-free coffee. Today's global market sees an increased demand for high-quality coffee with marked sensory traits (Seninde et al., 2020), which boosts the marketability and demand for speciality coffee types (Barbosa et al., 2020).

Coffee is one of the most popular global beverages, whose sensory and physiological traits created a high demand for the product in non-traditional markets (Khalif et al., 2022). We currently witness a growing interest in caffeine-free coffee (Seremet et al., 2022). Caffeine is also present in tea. On top of its stimulative effects, the drug's overdose causes various diseases and pollutes the environment, giving way to highly demanded decaffeinated products (Jiang et al., 2019). Consumers have recently increased the demand for quality and healthy drinks, including coffee (Rocchetti et al., 2020). Toraja is a globally renowned coffee grown in Tana Toraja Regency. Despite its limited production, the public demand for the commodity is high (Salam et al., 2021). The growing global interest in unusual coffee varieties calls for standardized and streamlined quality assessment (Giacalone et al., 2019).

Coffee price and quality depend on the type, variety, growing locality, green coffee grain processing and careful production methods (Benes et al., 2020). Consumers want a distinctive coffee aroma, determining the price (Caporaso et al., 2022). The sector producing rare coffee opens opportunities for growers and other partakers, increasing the product's value in the supply chain, driven by inflated consumer purchase prices (Schuit et al., 2021). Curl bugs damage coffee cherries, thwarting coffee yields, quality and production (Hollingsworth et al., 2020). Good roasting, forgery and defective grain detection, unique coffee quality, sensory attributes, chemical composition, coffee varieties and types and geographical origin deeply affect the product's quality and price (Munyendo et al., 2022). Coffee processing methods involve dry, semi-dry and wet techniques, classified by different production processes and product tastes. The varying costs of these processing approaches reflect various coffee grain prices (Karim et al., 2019). In July 2020, the Brazilian state of Minas Gerais, the largest global coffee producer, witnessed severe frost, damaging roughly 30% of local coffee trees. Then, coffee prices soared exorbitantly (Kim and Kim, 2022).

The coffee supply depends on many factors, including low productivity, poor quality, adverse weather and coffee tree diseases. Inelastic supply and demand may cause fluctuations in coffee market prices (Kuswardhani and Yulian, 2019). Sephton 2019 argues El Nino and La Nina have harmed many coffee types, exploring the impacts of climate change on coffee production in Southern Ethiopia. Prolonged dry spells, irregular and insufficient precipitations, temperature increase, or, on the contrary, unexpected heavy rainfalls and snowfalls, pests and diseases, declining soil fertility and weed infestation seriously damage coffee production, quality and costs (Abebe, 2021). Many experts monitored the impact of Covid-19 on the prices of major agricultural commodities, including coffee, using daily data from 1.1.2016 to 25.2.2022. The pandemic slashed the values of farm goods on markets and hugely increased market risk (Balçilar et al., 2022). Coffee production and profitability in Central America face the danger of pest infestation and diseases,

price fluctuations and climate change (Lopez-Sampson et al., 2020). Umakanthan and Mathi, 2022 proved that MIRGA technology improved the properties of coffee products and reduced the caffeine content to stimulate healthy consumption and enhance the taste. On top of the health improvement, the technique made the products more affordable.

The article aimed to explore the demand for coffee in the selected EU countries. The demand function involves the relationship between the demanded quantity of coffee and the price. The law of diminishing demand holds that the sought-for amount goes down if the product price rises (excluding changes in prices of other products and incomes). The consumer income is vital since growing retirement benefits will stimulate the demand for coffee and vice versa.

The demanded quantity of coffee depends on the price and label. Some people favour luxury brands, while others prefer cheaper goods.

The coffee price also rests on crops and weather. Poor harvest entails a lack of coffee and its price rise, whereas its prices slump in overabundance.

3 Data a methods

We formulated the following research questions:

- RQ1: Which indicators determine the demand for coffee?
 RQ2: Which indicators determine the coffee price?
 RQ3: What is the relationship between the coffee demand and price?

Research Question 1 involves a content analysis of scientific articles from the Web of Science, using sources containing 'coffee' AND 'demand' as keywords for the last five years.

Research Question 2 follows the same pattern, including 'coffee' AND 'price' as access words for the last five years.

The content analysis covers 13 articles for RQ1, measuring the following factors affecting the demand:

- Coffee quality
- Rare and healthy coffee
- Uniqueness and rarity of the coffee
- Certified coffee
- Ecolabels
- Decaffeinated coffee
- Sensory and physiological traits
- Human diseases
- Polluted environment

The demand for quality, rare, healthy and decaffeinated coffee grows as an increased amount of caffeine may be harmful. People seek certified, unique, rare coffee with appealing sensory and physiological traits, preferring eco-friendly and health-protecting labels.

Research question 2 involves 13 sources, including the following factors:

- Weather and climate change
- Pests and plant diseases
- Location of growing
- Low soil fertility and weed infestation
- Types and varieties
- Coffee quality
- Processing and roasting
- Production processes
- Coffee aroma
- Covid-19

Climate change complicates coffee cultivation, resulting in inflated prices, pest blight and diseases afflicting coffee trees. Although worsening soil fertility and weed infestation

tremendously increase coffee prices, we still pay more for high-quality, speciality varieties involving costly production.

Research Question 3 tackles the price elasticity of demand, explaining the relationship between the quantity (coffee) demanded and its price. We also explore the elasticity of a pensioner's demand of income, the proportional changes between the quantity demanded (Q) incomes (I). The formula for the price elasticity is as follows:

$$E_{(p)} = \frac{\Delta Q/Q}{\Delta P/P}$$

Where:

- $E_{(p)}$ is price elasticity of demand,
 ΔQ changes in volumes of coffee consumed,
 Q volume of coffee consumed,
 ΔP changed coffee prices,
 P coffee prices.

The coefficient of the price elasticity will decide whether the demand is elastic or inelastic. We consider the demand elastic if $1 < E(p) < 2$ and the perfectly elastic demand is when $E(p) > 3$. The unit elastic demand is 1. We regard the demand inelastic if $0 < E(p) > 1$ and the perfectly inelastic demand is when < 0 .

The formula for calculating the elastic income demand is as follows:

$$E_{(d)} = \frac{\% \text{ change the quantity required}}{\% \text{ pension change}}$$

$$\frac{\% \text{ required quantity changed}}{\% \text{ income changed}}$$

and

$$E_{ID} = \frac{\frac{Q_2 - Q_1}{Q_1 + Q_2}}{\frac{I_2 - I_1}{I_1 + I_2}}$$

here

E_{ID} is elastic income demand.

Luxury goods have the elastic income demand $E_{ID} > 1$, necessary goods $0 < E_{ID} < 1$ and inferior goods $E_{ID} < 0$.

4 Results

RQ1: Which indicators determine the demand for coffee?

We identified factors behind the demand for coffee, including quality, rarity, health, uniqueness, certification, ecolabels, decaffeinated coffee, sensory and physiological traits, human diseases and environmental pollution.

RQ2: Which indicators determine the coffee price?

Factors behind the coffee price involve weather and climate change, pests and plant diseases, geographical location of growing, low soil fertility, weed infestation, types and varieties, quality, processing methods, roasting, production techniques, aroma and Covid-19.

RQ3: What is the relationship between the coffee demand and price?

Table 1 suggests the results of the price elasticity of the demand in selected countries.

Table 1

	Elasticity NV	Elasticity RV	Elasticity NV	Elasticity RV
Austria	0.15	-0.10	Inelastic price of demand	Perfect inelastic demand
Belgium	0.07	0.27	Inelastic price of demand	Inelastic price of demand
Bulgaria	0.35	0.06	Inelastic price of demand	Inelastic price of demand
Cyprus	0.15	-0.25	Inelastic price of demand	Perfect inelastic demand
Czechia	0.20	0.30	Inelastic price of demand	Inelastic price of demand
Denmark	0.05	0.25	Inelastic price of demand	Inelastic price of demand
Finland	-0.40	-0.05	Perfect inelastic demand	Perfect inelastic demand
France	0.40	0.55	Inelastic price of demand	Inelastic price of demand
Germany	0.20	0.15	Inelastic price of demand	Inelastic price of demand
Hungary	0.00	-0.20	Perfect inelastic demand	Perfect inelastic demand
Italy	0.25	-0.15	Inelastic price of demand	Perfect inelastic demand
Latvia	-0.05	0.15	Perfect inelastic demand	Inelastic price of demand
Lithuania	0.00	-0.40	Inelastic price of demand	Perfect inelastic demand
Luxembourg	-0.26	-0.32	Perfect inelastic demand	Perfect inelastic demand
Malta	0.20	0.00	Inelastic price of demand	Perfect inelastic demand
Netherlands	0.55	0.35	Inelastic price of demand	Inelastic price of demand
Poland	0.20	0.00	Inelastic price of demand	Perfect inelastic demand
Portugal	0.15	0.00	Inelastic price of demand	Perfect inelastic demand
Slovakia	-0.15	-0.30	Perfect inelastic demand	Perfect inelastic demand
Slovenia	-0.45	-0.20	Perfect inelastic demand	Perfect inelastic demand
Spain	0.40	0.45	Inelastic price of demand	Inelastic price of demand
Sweden	0.05	0.10	Inelastic price of demand	Inelastic price of demand
EU	-0.70	-0.45	Perfect inelastic demand	Perfect inelastic demand

Table 1 suggests a 'States', 'Nominal Value Elasticity' and 'Real Value Elasticity' columns.

Values higher than 3 suggest a perfect elastic demand, whereas numbers higher than 1 and lower than two indicate an elastic price of demand. A unit elastic demand equals 1, inelastic price of demand is higher than 0 and lower than 1, while a perfect inelastic demand goes below 0.

In Austria, nominal elasticity equals 0.15, which corresponds to price inelastic demand, while real elasticity equals -0.10, perfectly inelastic demand. In Belgium, nominal elasticity values are 0.07 and real elasticity values are 0.27, which in both cases indicate price inelastic demand. The elasticity in nominal value in Bulgaria reaches the result of 0.35 and the elasticity in real value is 0.06. In both cases, this is again a price inelastic demand. The nominal elasticity is as high as 0.15 in Cyprus, indicating that it is a price inelastic demand, while the real elasticity is equal to -0.25, where we find that it is a perfectly inelastic demand. The elasticity in the nominal value in the Czech Republic is 0.20 and the elasticity in the real value is 0.30, so it is a price inelastic demand. In Denmark, we again found price inelastic demand, as the nominal and real values are 0.05 and 0.25, respectively. In Finland, this is a perfectly inelastic value, as the nominal and real elasticities reach negative values. In France, we find that this is a price inelastic demand, as the nominal and real elasticity values are 0.40 and 0.55, respectively. In Germany, nominal elasticity equals 0.20 and real elasticity 0.15, again price inelastic demand. Hungary has achieved perfectly inelastic demand, as the nominal and real elasticities are 0.00 and -0.20, respectively. The nominal elasticity in Italy is 0.25, so it is price inelastic demand, and the real elasticity is -0.15, so it is perfectly inelastic. In Latvia, the level of elasticity in nominal value is -0.05, which corresponds to perfectly inelastic demand, and the level of elasticity in real value is 0.15, so it is price inelastic demand. In Lithuania, the nominal elasticity is equal to 0.00, which means price inelastic demand and the real elasticity is equal to -0.40, so it is a negative value and therefore perfectly inelastic demand. In Luxembourg, the elasticity in nominal and real value reaches -0.26 and -0.32, and therefore it is a perfectly inelastic demand in both cases. The nominal elasticity in Malta is 0.20, indicating price inelastic demand and the real elasticity is 0.00, thus perfectly inelastic

demand. The nominal and real elasticities in the Netherlands reached 0.55 and 0.35, respectively, where we found price inelastic demand. In Poland, the nominal elasticity is 0.20, which corresponds to price inelastic demand, and the real elasticity is 0.00, so it is perfectly inelastic demand. In Portugal, the nominal elasticity is as high as 0.15, which is equal to price inelastic demand, and the real elasticity is 0.00, which means that it is perfectly inelastic demand. In Slovakia, the elasticities in nominal and real value are -0.15 and -0.30, here it is evident that this is a perfectly inelastic demand. In Slovenia, nominal and real elasticities reach negative values, which corresponds to perfectly inelastic demand. In Spain and Sweden, it is a price-inelastic demand, both in the case of elasticity in nominal value and elasticity in real value.

Table 1 suggests a perfectly inelastic demand in the EU states, dropping into negative nominal and real values.

Table 2 illustrates the elastic income demand in the selected countries.

Table 2

	Elasticity NV	Elasticity RV	Elasticity NV	Elasticity RV
Austria	-0.25	-0.10	Inferior good	Inferior good
Belgium	0.00	0.20	Normal good	Normal good
Bulgaria	-0.29	-0.24	Inferior good	Inferior good
Cyprus	-0.05	-0.15	Inferior good	Inferior good
Czechia	-0.05	-0.05	Inferior good	Inferior good
Denmark	-0.15	0.05	Inferior good	Normal good
Finland	-0.15	-0.20	Inferior good	Inferior good
France	-0.15	-0.70	Inferior good	Inferior good
Germany	-0.40	-0.55	Inferior good	Inferior good
Hungary	-0.10	-0.15	Inferior good	Inferior good
Italy	0.05	-0.25	Inferior good	Inferior good
Latvia	-0.45	-0.50	Inferior good	Inferior good
Lithuania	-0.15	-0.10	Inferior good	Inferior good
Luxembourg	-0.05	-0.05	Inferior good	Inferior good
Malta	0.30	0.20	Normal good	Normal good
Netherlands	0.10	-0.20	Inferior good	Inferior good
Poland	-0.30	-0.30	Inferior good	Inferior good
Portugal	-0.15	-0.25	Inferior good	Inferior good
Slovakia	-0.30	-0.40	Inferior good	Inferior good
Slovenia	-0.25	0.05	Inferior good	Inferior good
Spain	-0.40	-0.25	Inferior good	Inferior good
Sweden	-0.35	0.00	Inferior good	Normal good
EU	-0.15	-0.10	Inferior good	Inferior good

Table 2 contains columns of 'states, nominal value elasticity and real value elasticity'.

For luxury goods, income elasticity values are greater than 1, for essential goods the value is greater than 0 and at the same time less than 1, and for inferior goods the value is less than 0, i.e. it reaches a negative number.

We found that in Austria, Bulgaria, Cyprus, the Czech Republic, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Slovakia, Slovenia and Spain, elasticities in nominal and real value reach negative values and therefore it is an inferior asset. In Belgium, the nominal and real elasticities are 0.00 and 0.20, respectively, corresponding to the current good. In Denmark, the amount of elasticity in nominal value is -0.15, which implies that it is an inferior good, while the amount of elasticity in real value corresponds to a normal good. In Malta, it follows from the elasticities in nominal and real value that it is a common good. In Sweden, the elasticity in nominal value is equal to -0.35, so it is an inferior good, and the amount of elasticity in real value is equal to 0.00, which is a normal good. Table 2 suggests that

nominal and real values indicate coffee as an inferior good. We also revealed that the EU countries do not consider the commodity a luxury good, as values did not exceed 1.

5 Discussion

RQ1: Which indicators determine the demand for coffee?

The coffee demand indicators in our content analysis involved quality, rarity and health stimulation, uniqueness, certification, eco-labels, decaffeinated products, sensory and physiological traits, human diseases and environmental pollution. Wahyudi et al. (2020) revealed an increased demand for quality and certified coffee, while Raveendran and Murthy (2022) indicated a growing need for rare, especially civet coffee. Gatti et al. (2022) proved rising consumers' interest in eco-labels. Seninde et al. (2020) argue that today's market abounds with a demand for high-quality coffee with significant sensory traits. Barbosa et al. (2020) and Khalif et al. (2022) concluded that good sensory and physiological characteristics match consumer tastes. Seremet et al. (2022) and Jiang et al. (2019) point to an increased demand for decaffeinated coffee and tea. Based on RQ3, we revealed that the demand for coffee in the EU is inelastic, involving the named factors. Low-class coffee discourages consumers, as people prioritize quality. Rare and healthy coffee products witness a growing demand owing to their sensory and physiological features.

RQ2: Which indicators determine the coffee price?

The coffee price indicators in our content analysis involved weather and climate change, pests and plant diseases, growing location, low soil fertility, weed infestation, type and variety, quality, processing methods, roasting, production methods, aroma and Covid-19. Benes et al. (2020) consider type, variety, growing location and processing methods as crucial factors influencing the price, while Caporaso et al. (2022) emphasize the aroma. Hollingsworth et al. (2020) claim that price is highly receptive to pest infestation, especially the curl bug. Munyendo et al. (2022) argue that roasting forgery and defective grain detection, rare coffee quality, sensory attributes, chemical composition, varieties, types and geographical origin are critical determinants of the coffee price. Karim et al. (2019) consider processing techniques highly instrumental in the observed variable, distinguishing dry, semi-dry, and wet methods. Costly approaches lead to higher prices. Kuswardhani et Yulian (2019) include low productivity and quality, adverse weather and coffee-tree diseases and inelastic supply and demand as decisive factors.

RQ3: What is the relationship between the coffee demand and price?

We found a perfectly inelastic coffee demand in the EU, indicating negative real and nominal elasticity. Values above 3 demonstrated a perfectly elastic demand, whereas rates higher than 1 and lower than 2 showed an elastic price demand. A unit elastic demand reached 1, and inelastic price demand exceeded 0 and was lower than 1. A perfect inelastic dropped below 0 – into negative numbers. Although the EU demand for coffee is perfectly inelastic, Belgium, Bulgaria, the Czech Republic, Denmark, France, Germany, Holland, Spain, and Sweden indicated inelastic price demand. Our survey also revealed that coffee is an inferior good, not exceeding 1. Luxury goods surpassed 1, necessary goods were higher than 0 and lower than 1, while inferior goods dropped below 0 – negative numbers. Table 2 suggests that no country considers coffee a luxury good in a nominal or real value. Although the EU states rank the commodity among inferior goods, some countries did the opposite. Belgium and Malta view the asset as a normal good in both values. Vochozka et al. (2022) disclosed that coffee falls into low-quality goods with near-to-perfect inelastic prices.

6 Conclusion

The article explored the demand function for coffee in the selected EU countries, using a content analysis, price elasticity calculation and income elasticity.

The content analysis unveiled 13 factors behind the coffee demand, including the quality, rare, healthy, unique and certified coffee, eco-labels, decaffeinated products, sensory and physiological traits, human diseases and environmental pollution as main determinants. The consumer demand grows with quality, certified, unique and rare products. Many people support pesticide-free production, kindling the interest in eco-labels. Remarkable sensory and physiological features extend the appeal. Caffeine-free products also gained in popularity, as an increased caffeine intake may cause diseases and environmental pollution. The content analysis revealed 13 factors behind coffee prices including weather and climate change, pests, plant diseases, growing location, low soil fertility and weed infestation, type and variety, processing methods and roasting. Adverse weather, i.e. heavy rainfalls, low precipitations, high temperatures, drought, sharp temperature drops, frost and heavy snowfalls, inflate the coffee price. These factors reflect climate change, hampering production and quality. Damaged coffee trees raise global market coffee prices, which fluctuate owing to inelastic supply and demand. Weather changes cause soil infertility, infested with weeds and pests, especially the curl bug. These issues seriously harm production volumes and prices. The Covid-19 pandemic inflated coffee prices, slashing the values of commodities on agricultural markets. We also studied the relationship between the demand for coffee and its price, measuring the price and income elasticity of the demand.

The results indicated elasticity or inelasticity as follows: a value higher than 3 shows a perfectly inelastic demand, while values exceeding 1 and lower than 2 suggest an elastic price demand. A unit elastic demand equals 1, inelastic price demand surpasses 0 and settles below 1, and perfectly inelastic demand drops under 0, i.e. negative numbers. Negative nominal and real elasticity values for the EU ranged between -0.70 and 0.45, indicating a perfectly inelastic demand. Belgium, Bulgaria, the Czech Republic, Denmark, France, Germany, the Netherlands, Spain and Sweden showed an inelastic price demand. Belgium's nominal and real value equalled 0.07 and 0.27 respectively, demonstrating an inelastic price demand. Bulgaria witnessed a nominal and real value at 0.35 and 0.06, while the Czech Republic was 0.20 and 0.30. Denmark topped 0.05 and 0.25, whereas France peaked at 0.40 and 0.55. Germany showed values of 0.20 and 0.15 and the Netherlands 0.55 and 0.35. Spain saw values of 0.40 and 0.45, while Sweden demonstrated 0.05 and 0.10. Austria had a nominal value of 0.15, indicating inelastic price demand, whereas the real value was negative, demonstrating a perfectly inelastic demand. Cyprus indicated a nominal value of 0.15, showing an inelastic price demand, while negative numbers of the real value implied a perfectly inelastic demand. Italy had an inelastic price demand reaching 0.25 in the nominal value and a perfectly inelastic demand, dropping below 0. Latvia witnessed a negative nominal value, indicating a perfectly inelastic demand, yet peaking the real value at 0.15, suggesting an inelastic price demand. Poland and Portugal demonstrated nominal values of 0.25 and 0.15, implying an inelastic price demand and real values of 0.00, showing a perfectly inelastic demand.

Factors behind the demand for coffee created a perfectly inelastic demand in the EU. Poor-quality coffee is not interesting for consumers who want excellent, rare, and healthy products.

We also determined if the commodity involves luxury, necessary or inferior goods, setting values exceeding 1, higher than 0 and lower than 1 and dropping below 0, respectively. Our findings revealed the EU considers coffee an inferior good in both measured values (nominal and real), indicating negative numbers. Table 2 shows that the EU excludes the commodity from luxury goods, showing values below 1. Belgium ranks coffee among normal goods, indicating 0.00 of a nominal value

and 0.20 of a real value. Malta involves the commodity in the same rank, showing a nominal and real value of 0.30 and 0.20, respectively. Denmark saw the nominal value peak at -0.15, corresponding to an inferior good, whereas its real value topped 0.05, referring to normal goods. The same scenario unfolds in Sweden, where the nominal value was negative and the real equalled 0.00, demonstrating inferior and normal goods accordingly.

We fulfilled our research aim, revealing perfectly inelastic demand for coffee in the EU. The quantity demanded is independent of the changes in coffee prices, indicating no change in the amount wanted despite fluctuating prices (no elasticity). Coffee in the EU ranks among inferior goods, showing a declining demand despite growing incomes.

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THE EFFICACY OF “SOFT” SKILLS TRAINING AND DEVELOPMENT: QUALITATIVE SURVEY OF THE EXPERIENCES OF CZECH BUSINESSES

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This paper is a partial output of the project of the project VŠTE v Českých Budějovicích, “IVSUPS2303 - Identification of elements of ethical management and CSR in SMEs”.

Abstract: “Soft” skills training and development courses often have a limited impact, even if employees are satisfied with the results. The reason is the nature of such skills, which may require employees to shed deeply rooted habits before developing new skills. The lack of efficacy of such training courses is often related to their poorly defined focus and content, as well as to the unprofessional methods applied, which in some cases is associated with the low quality of the lecturers. These factors, acting in combination, can sometimes lead to the illusion, on the side of companies or their managers, that those employees who have completed such training courses have mastered certain soft skills, while in truth the situation is very different. The article deals with the specific features of soft skills compared to their “hard” counterparts, how this affects the efficacy of such training courses, the most common reasons why soft skills training courses do not deliver the expected results, as well as ways how to tackle the problem. A qualitative survey was conducted to determine to what extent medium-sized and larger Czech companies are aware of the potential flaws and the lack of efficacy of soft skills training courses and what methods can be applied to resolve this and with what results.

Keywords: Soft skills, employee training and development, training efficacy, methods for improving efficacy of training and development

1 Introduction

It goes without saying that soft skills are crucial in a lot of occupations and work environments (Akla & Indradewa, 2022; Dean & East, 2019; Sharma, 2018). The requirement for employees to master these abilities is therefore growing (Burbekova, 2021; Hirsch, 2017; Schislyayeva & Saychenko, 2022). They are needed for effective communication and cooperation with others, and thus important wherever work results depend on smooth work coordination. They are important for negotiation, team work, creating mutual trust, good interpersonal relationships, common problem solving, overcoming conflicts, reducing work stress (Molek-Winiarska & Kawka, 2022; Baron & Morin, 2010; Vasanthakumari, 2019), etc.

These skills are also increasingly becoming important for successful employee “self-management” (Jones, et al., 2017, Khilji, & Roberts, 2021), i.e. in situations where employees have to work without direct supervision or guidance from a superior. Within this context, such skills must cover, for example, the ability to plan and effectively use one’s time, motivate oneself, check ones’ own work progress and resist stress (Börner, et al., 2018), etc.

Honing these skills is also important for the successful management and leadership of others (Lok, et al., 2021). The ability to set an example, inspire confidence, influence, motivate, encourage and evaluate colleagues, develop and inspire others, delegate based on the development of employee abilities and build and lead teams (Hendarman & Cantner, 2018; Semenova, et al., 2021; Riyanti & Sandroto, 2016), are key.

Overall, there is a proven link between the level of the soft skills of managers and employees and their individual performance and that of the company as a whole (Howes, et al., 2017; Ibrahim, et al., 2017; Johnson, 2021).

Unfortunately, referring to these skills as “soft” is not very appropriate because it inadvertently suggests that they are easy to comprehend and learn (Adhvaryu, et al., 2018), whereas the contrary is true. Unlike “hard” skills, be they technical, computer, legal, or other (e.g. the ability to operate certain machinery or comply with new legislative rules), the training of

which usually does not present a major problem, soft skills training is often much less effective and requires more time. In addition, group training of such skills may not always be the most effective way of developing them, with more individual forms of education potentially being required (Gibert, et al., 2017).

There are four main reasons for the lack of efficacy of soft skills development. The first reason is that the contents/goals of hard skills training courses can usually be clearly defined, whereas for soft skills they often suffer from being vague. In other words, there is a lack of clarity and understanding of what particular skills employees should learn (Botke, et al., 2018; Botke, et al., 2017).

The second reason is that, unlike for hard skills, good lecturers of soft skills are not abundant (Asbari, et al., 2020). The lecturers/soft skills training companies used by businesses are often not fully up to their job, lacking training expertise.

The third reason is that soft skills training, to be effective, relies on some very “hard” rules (Iorio, et al., 2022) that, unlike hard skills that are usually relatively easily transferable (most often using the method of instruction), require the application of a combination of training methods or more complex ones.

The fourth reason is that the need for employees and managers to acquire new hard skills is usually clearly visible within an organisation, or easy to explain to them direct (Santos, et al., 2017). As far as soft skills are concerned, the visibility of their practical importance tends to be lower, with some employees potentially having a problem admitting to a lack of knowledge in this area and therefore the need to develop such skills (Nusrat & Naz, 2018).

2 Theoretical backgrounds: literary research

The most common shortcoming of soft skills training courses are that they are not properly focused (Espina-Romero, et al., 2023; Saranya & Guduru, 2022). This usually concerns situations where the focus/aim of the training course is not based on a thorough analysis of the skills development needs of the organisation and its employees, but rather based on the proposals and recommendations of external trainers or training organisations that offer their services (Kic-Drgas, 2018; MacDermott & Ortiz, 2017).

A similar problem arises when the goals of soft skills training courses are not specific enough. As a result, checking the achievement of the goals at the end of the course proves difficult. There is namely a difference between a training course focused on “communication skills” without any further concrete training goal and a training course whose stated goal is “to learn to overcome objections of the counterparty regarding the excessively high price of a certain product or service in a business/customer negotiation” (Urban, 2018).

A similar example is the difference between a “social skills” course on the one hand and a training course in “the ability to listen actively to the other side in a conversation and inspire trust” (Meeks, 2017).

Misconceptions about soft skills

The aforementioned problem is often aggravated by misconceptions of the substance of social skills, even of the most important ones. Within this context, it is not uncommon for lecturers, as well as the companies that hire them, to misunderstand the methods for training, acquiring and developing the soft skills they want to transfer. A common reason for this is that training courses are often conducted by lecturers without the appropriate education, psychological or

pedagogical, or even by persons who have no previous experience in the training field.

This can potentially lead to situations where the lecturer's idea of what a particular social skill is about is not only inaccurate, but even misleading (Iorio, et al., 2022). The trust a company places in the trainers in cases like this may therefore result in the "skills" the trainees learn, as far as the content thereof is concerned, not corresponding to the skills they should acquire (Jardim, et al., 2022).

A training course on "stress management", the main focus of which is relaxation techniques an employee should use after being exposed to severe or long-term work stress, is used here by way of an example. These techniques, though sometimes helpful, do not deal with the primary issue of "stress management", which equates to stress prevention, and do not take into consideration that the impact of various stress factors depends to a large extent on how they are handled or even interpreted by the person in question.

One of the main sources of stress lies in how people deal with stressful social situations, which are intrinsic by their very nature. A training that overlooks this phenomenon can therefore never be very effective.

The same may apply to the fact that stress at work can quite often be substantially minimised when people learn how to change their counterproductive habits that determine their behaviour in certain situations. If they succeed, they will not have to use the relaxation techniques because their stress will be greatly diminished (Majid, et al., 2019).

A similar example is the generic training course on "time management", which does not take into consideration that the main prerequisite for effective time management is managing oneself. In other words, the development of one's ability to successfully face or even welcome disruptions, both internal and external, that prevent us from performing activities that are necessary or unpleasant.

Unfortunately, no technical "time management" rules can help in this regard. It goes without saying that time needs to be planned. However, if we really want to stick to a plan, it is often necessary to adopt or use certain psychological methods that create or strengthen one's own motivation to carry them out, which can, for example, fall into the category of autosuggestion (Chakraborty, et al., 2017).

Within this context, a "time tamers" training course offered by an educational company therefore has a ring of the unreal about it. The company or lecturer who offers it probably believes that time can be tamed in order to use it more effectively, perhaps to even make it run more slowly. As with the term "soft", the term "time management" is not very appropriate because time cannot be managed, it can only be used more or less efficiently.

Another example concerns a soft skills training course focused on leadership, the instructor of which claims that a good leader should be "invisible". They therefore train participants to "become an invisible leader". Regardless of this non-sensical approach to leadership, some of the participants of the training may be convinced of the importance of this ability. This despite the fact that in reality it is acknowledged that a leader must be very visible to be successful (and even more so in crisis situations) in order to be able to, among other things, set an example, instil confidence in employees, provide security in difficult situations, as well as to not only formulate, but also personally convey their vision.

The last example is that of a motivational skills course, the "lecturer" of which is of the opinion that it is not appropriate to praise employees too often and/or too much because this could "spoil" them.

Practice, however, does not record such cases (which are contrary to the psychological theory of reinforcement). The lecturer may have meant that excessive praise that is not specific can sound unconvincing or even manipulative. However, employees or managers should definitely not take away from the training the idea that if we praise someone, their motivation will decrease because they will "rest on their laurels".

Difference in the nature of soft and hard skills and its impact on their training

The lower efficacy of soft skills training courses is often related to the nature of the skills themselves, i.e. the essence of the difference to "hard" skills (Almeida & Morais, 2023; Iorio, et al., 2022). The difference lies not only in the fact that it is more difficult to (correctly) define, explain and assess them, but also in the often firmly rooted social and communication skills with which people come to organisations.

These are not skills, but often habits, picked up in previous jobs, or even before starting work. Some may be effective, but others problematic. Developing new social skills is more difficult in these situations. It requires not only the acquisition of new skills, but also the destruction or replacement of old ones (Myers, 2021; Ooi & Ting, 2015).

The brain, much like a computer processor, processes information. Unlike a computer, however, it does not allow unwanted programmes controlling human reactions to be simply removed, figuratively speaking, by pressing the "delete" button. Behaviours are "physically set" by built-in neural connections, whereby any new behaviours, even those that are reasonable and desirable, are borne with difficulty (Putra, et al., 2020).

The only permanent way to create a new way of behaving, replacing the old way, is to create a "new or corrective experience" for that person. The essence of this procedure is that the new behaviour "delivers better results". In other words, it is appreciated and supported by the environment: if the new way of behaving is supported by the environment for a long enough time and therefore proves to be more successful, the hope is that a new brain will also be created with neural connections that lead to it (Santos, et al., 2017).

It follows from the results of studies dealing with the functioning of the brain that the only way to achieve a permanent change in human behaviour is to "reinforce" these changes over the long term, i.e. to support and thereby fix them. The basis of this support is usually immediate and positive feedback. Simply put, immediate praise ().

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Hard rules of soft skills trainings

Even the idea that soft skills are essentially a free "art" that can easily be learned through practice or that can be acquired together with other course participants is often harmful or inappropriate.

Soft skills training courses should, of course, benefit from discussions with participants. However, most soft skills, like hard skills, have their own rules. These are principles that are mostly based on long-term research or experience, the results of which cannot simply be derived in group discussions (Börner, et al., 2018). This applies, among other things, because some of these principles are counter-intuitive in nature. In other words, they do not fully correspond to what seems obvious at first glance, or to how people behave in practice in certain situations (because they believe that they will be successful).

An example is the psychologically proven assumptions on which the ability to convince or act trustworthy is based. One of them is that if we want to convince someone, we should not “press” them too much. It is better to leave at least some space for them to derive the opinion or decision to which we are trying to lead them on their own.

Similarly counter-intuitive is the principle that effective conflict resolution usually requires preventing a dispute turning into a confrontation. Confrontational resolution of a dispute reduces the willingness of the other party to come to our aid, or even gives them arguments as to why they should not even try. In practice, however, and contrary to this proven principle, people often believe that in the event of a conflict, the other side should be “hit” and therefore forced to make concessions. The idea that if we get upset the stress will go away, is usually wrong. Inevitably, the stress returns very quickly as soon as we find out that we have not achieved anything by being upset (Vinichenko, et al., 2020).

The hard rules or principles on which soft skills are based apply to even the most demanding of them. This applies, for example, to the ability to lead: although certain innate prerequisites (personal “charisma”) undoubtedly contribute to it, it can also be learned, based on proven ways of behaving and communicating by successful leaders. However, even these rules, which are appropriate to follow, need to be learned, sometimes in a way that can resemble the acquisition of “hard” or factually based skills (Sousa & Rocha, 2017).

The need for longer-term support

Without this long-term support or reinforcement, new ways of behaving will not be formed, with most people, sooner or later, reverting to their old ways, i.e. those behaviours learned and fixed in the past or that they grew up with. As a result, their behaviour remains more or less unchanged (Naamati Schneider, et al., 2020).

Even a longer and/or more demanding soft skills training course may not achieve a substantial result if it is not followed through with significant support for the use of the skills within the work and/or social environments, especially from direct superiors. In such cases, the results of the training will remain below expectations and the return on investment will be low.

This applies even to intensive multi-day training courses, including those that use individual or group exercises that apply the role-play method (Espina-Romero, et al., 2023), the participants of which really try to change their behaviour. Trainings alone, cannot create new skills. They do not provide sufficient long-term support, which is necessary for new behaviours to take root. Their main contribution lies primarily in the fact that they constitute a necessary first step or “introduction” to new behaviours and the correct procedures or methods for solving certain social situations. However, they must be followed up by a long-term strengthening of the newly learned behaviour.

In other words, if an employee returns to their workplace after completing training, they need a supervisor, co-worker, or another person next to them to provide them with feedback, guidance and support on an ongoing basis. If they don't, their behaviour quickly reverts to that of the past.

Top-down progression

The aforementioned principle also leads to the fact that an effective development of soft skills usually only works in an organisation based on a top-down approach (Majid, Shaheen, et al.). It starts with changing behaviour at the highest levels of corporate management and continues with the training or coaching of people at lower levels.

As part of this procedure, managers who have adopted the new behaviour become coaches or trainers of the people they manage. These persons, if they are also leaders, for example

team leaders, in turn strengthen the development of the soft skills of the members of their groups.

An important prerequisite for the efficacy of this procedure is to set clear expectations for change, provide regular and frequent feedback, as well as motivation for the development of new skills.

Objective assessment of soft skills

The objective assessment of employee soft skills, pointing out to the main strength as well as weaknesses of individual persons, also serves to develop soft skills (Cotet, et al., 2017; da Silva, et al., 2021). Its easiest and most effective way is feedback, which occurs not only from superiors, but also from subordinates, colleagues or customers. If it is designed correctly, it gives a relatively accurate assessment of abilities that can otherwise often be assessed only with difficulty or whose assessment sounds subjective.

If we identify the main weak points in the soft skills of each person before starting their development, this brings us two advantages. On the one hand, the training and coaching program can be focused on the areas in which the need for improvement is greatest, and on the other hand, the participants of the training and subsequent development program will gain a stronger motivation to change. In addition, weaknesses identified by feedback can be re-examined over time, so development program participants get immediate information on what improvements they have already made.

External coaching

The development of soft skills, supported by coaching, is important/particularly suitable for employees who have already acquired the basic skills necessary to perform their job, but who are starting to encounter problems when applying them, and, as a result, are losing confidence in themselves (Baron & Morin, 201).

In such situations, an external coach can help not just with new skills development, but also with providing motivational support for the learning thereof (Majid, et al., 2019). This involves instilling the employee with the necessary self-confidence and motivation to use their newly acquired skills and showing them that they can handle more demanding situations or apply those skills independently.

When giving guidance to employees, helping them to find the right solution, the coach usually asks so-called guiding and/or indirect questions. These questions are designed to lead the trainee towards new approaches. Examples of such questions are: “What are your options for moving forward?”, “What do you think you could do differently?”, “What would happen if...”, “Do you see any way we could speed things up?”, “What do you think about the possibility of...?”, “Is there anything about your job that makes you nervous or uncomfortable?”

One of the most important personal prerequisites for a coach's success is patience. They should respect the fact that it takes a certain amount of time to develop soft skills and gain experience of their use, which may vary from employee to employee. However, differences in learning speed do not necessarily mean that employees who are “better” at learning soft skills will also be better at actually performing them within their job. Consistency, the ability to monitor and evaluate performance and clearly formulate set goals are also important.

3 Methodology and Data

The purpose of the analytical part of this article, which is based on the qualitative analysis of the results of a questionnaire survey and semi-structured interviews, mainly with human resource managers of medium-sized and large companies, was to determine what importance the surveyed companies attach to efforts to maximise the efficacy of the training and development

of new soft skills, thereby taking into consideration that the efficacy of such training courses is often relatively low (especially when compared with the results of "hard" skills training courses).

The research questions specifically covered the following issues:

- (i) Do the surveyed companies purposefully attempt to increase the efficacy of their soft skills training courses to avoid falling into the trap of believing their employees have mastered certain skills, even though they have not?
- (ii) What specific methods for increasing the efficacy of their soft skills training courses do the surveyed companies use (or, have they developed) and which of these methods would they recommend?
- (iii) Which methods, if any, do the surveyed companies use for evaluating the results of their soft skills training courses.

Data collection was carried out in the first half of 2023 on the basis of simple random sampling. The sample set consisted of companies operating mainly in Prague and central Bohemia. In total, 36 companies were included in the research. The number of employees in these companies ranged from 345 to 854 people. The majority of the companies operate in manufacturing, logistics, trade, finance and personal services.

4 Results

The results of the analyses of the research questions, based on the responses to the questionnaire survey and interview statements, were the following:

(i) Most of the surveyed companies did not purposefully attempt to increase the efficacy of their soft skills training courses and do not make a principal difference between soft and hard skills training activities. Only 18% claimed that soft skills training, due to the nature of these skills and the specific requirements regarding the training thereof, deserve a special approach. The majority (63%) did, however, recognise the importance of soft skills, mainly communication and management skills, and try to come up with more and individualised methods for the development thereof, mainly through coaching. At the same time, the majority of the companies are convinced that the training of employees in the field of soft skills should be entrusted to persons who have both the professional and personal prerequisites to do so. When it comes to external lecturers, it is therefore important to diligently check their credentials and not just trust the claims of educational companies. In the case of internal lecturers, the trainers themselves need to be trained first.

(ii) Unlike training courses for hard skills, more than half (69%) the surveyed companies feel that one of the most important ways to increase the efficacy of soft skills training courses is to involve employees (participants) in the planning thereof, both in terms of focus and methods used. Within this context, the role-play method is often used. However, rather than increasing the efficacy of the training course, it is more likely to be used as an instrument to raise employee interest and satisfaction with the execution thereof.

(iii) Only a minority (15%) of the surveyed companies clearly define the goal of the training course in terms of specific social skills required in a concrete situation. Likewise, only 38% use a method of evaluation to determine whether the trained skills have improved. Practically all of them (95) do, however, get feedback from participants of training courses, though this feedback typically does not concern an objective evaluation of the acquired skills.

(iv) Although more than a half (78%) of the surveyed companies have a relatively clear idea of the area the training course should be focused on, they leave plenty of space for the lecturer to determine the specific contents of the training course. The majority (71%) do not feel the need to monitor the training, either through a HR specialist or a line manager.

(v) About one-third of the surveyed companies stated that the higher efficacy of soft skills training courses requires the establishment of standardised content, uniform procedures and proven principles upon which the training of such skills is based. According to their experience, it is advisable to create written manuals for employees, the aim of which is to specify the main points of the newly acquired skills and to even highlight the use thereof in situations they might commonly encounter at work, including their resolution. These requirements are, however, as they admit themselves, not always fulfilled.

(vi) The prevailing view (70%) among the surveyed companies is that it is usually not enough to explain or demonstrate new skills to employees. If they are to learn new skills, they need to acquire them based on their own practice and/or experience. For positions where employee failures can cause serious problems (including senior positions), training should be based on practicing simulated situations. One of the goals of this training is to alert employees to potential mistakes before they make them while actually performing their tasks.

(vii) When developing soft skills, it must be assumed that a few days of training alone is not enough to acquire them. Long-term attention, support and feedback from a superior or external coach, and sometimes even repeated training courses, are also important.

(viii) Most of the surveyed companies (68%) agreed it is important for their employees to gain trust in the need for and use of their newly acquired soft skills. An important part of soft skills training courses is therefore convincing the employees that the skill they are learning is appropriate, important and effective. The reason for this being that they may have personal doubts as to whether the new skills are really more effective than the skills they already possess and have used in the past. Overcoming the employee's distrust in the new skill should be based on practical illustrations. An example, as given by one of the companies, was a situation in which a lecturer/superior advised an employee, handling complaints, not to argue with the person who is complaining. The reason for this being that it is very likely to calm the situation down sooner. However, the employee did not agree with this procedure. They argued that if they did not argue with the complainant about the content of their complaint, their position becomes weaker and that of the complainant becomes stronger.

(ix) Objections to a certain course of action are often found to be stronger on the part of leaders. Their views on, for example, how to manage their subordinates sometimes differs significantly from what their trainers, organisations or coaches deem appropriate. These situations, even more so than the previous one, have to be handled in soft skills training courses. Companies are, however, increasingly coming to the conclusion that training is not an effective way to solve this issue. Almost half (45%) of the surveyed companies agree that this is an issue which can be best handled through coaching.

(x) Resistance to changing habitual procedures (and sometimes even prejudices) should be regarded as natural, which is something superiors should anticipate in advance. The majority (79%) of surveyed companies stated that the superior should give the employee time to familiarise themselves with the new soft skill and gradually accept it as their own, and that they should not promote the adoption thereof too quickly. Too much pressure placed on employees can increase their resistance. This rejection can then be difficult for them to take back.

(xi) At least in theory, most of the surveyed companies agreed that for all major soft skills training courses, appropriate model situations must be created to verify that employees have actually learned the new skills. These situations should assess their ability to solve certain model social situations. If employees are unable to solve these, they need to either have follow-up training or have a coach to help them to do so.

6 Conclusion

The answers to the research questions revealed that most of the surveyed companies believe the nature of soft skills training courses requires them to be entrusted to persons who have both the professional and personal prerequisites to do so. When it comes to external lecturers, it is therefore important to diligently check their credentials and not just trust the claims of educational companies. In the case of internal lecturers, the trainers themselves need to be trained first.

Unlike training courses in hard skills, more than a half of the surveyed companies feel that one of the most important ways to increase the efficacy of soft skills training courses is to involve employees (participants) in the planning thereof, both in terms of focus and methods used.

Even though more than half of the surveyed companies have a relatively clear idea of the area the training should be focused on, only a minority clearly define the goal of the training course in terms of specific social skills required in a concrete situation. They therefore leave plenty of space for the lecturer to determine the specific contents of the training course. In addition, only a minority of the companies use a method of evaluation to determine whether the trained skills have improved.

About one-third of the surveyed companies stated that the higher efficacy of soft skills training courses requires the establishment of standardised content, uniform procedures and proven principles upon which the training of such skills is based. In addition, according to their experience, it is advisable to create written manuals for employees, the aim of which is to specify the main points of the newly acquired skills.

Most of the surveyed companies agreed it is important for their employees to gain trust in the need for and use of their newly acquired soft skills. An important part of soft skills training courses is therefore convincing the employees that the skill they are learning is appropriate, important and effective.

The prevailing view is that resistance to changing habitual procedures (and sometimes even prejudices) should be regarded as natural, which is something superiors should anticipate in advance.

Most of the surveyed companies agreed that for all major soft skills training courses, appropriate model situations must be created to verify that employees have actually learned the new skills. These situations should assess their ability to solve certain model social situations. If employees are unable to solve these, they need to either have follow-up training or have a coach to help them to do so. This practice, however, is used by just a minority of the companies.

The conducted survey did not find any significant differences between companies from different industries. Larger companies were, however, usually stricter in their adherence to the principles of effective soft skills training and claimed to use a broader array of guidelines covering their execution. Regardless of company size and industry, the most space for improving soft skills training lies in the clear and unambiguous definition of the content of the soft skills to be learned, clear training goals and the evaluation of the results thereof.

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Primary Paper Section: A**Secondary Paper Section: EA, AH**

CZECH AND SLOVAK SYSTEMS OF INSTITUTIONAL CARE: DIFFERENT APPROACHES, COMMON GOALS

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This paper was written in the framework of research and development of methodology for working with disadvantaged youth SML/2023/0142, which was commissioned by Czech National Agency for International Education and Research.

Abstract: The main aim of the paper is to present the results of a qualitative research that mapped the situation in the field of institutional education in the Slovak Republic and the Czech Republic. In the paper we will introduce the system of institutional education in the Slovak Republic and the Czech Republic and describe the most important legislation. At the end of the paper, we will discuss the findings that we have observed during our research. We will point out the common areas and the most significant differences. Our paper will offer an opportunity to better understand the specifics of each system of institutional education.

Keywords: Institutional Education, Children's Home, Centre for Children and Family

1 Introduction

Our society is undergoing rapid change, with one of the most significant being the emergence of globalisation. It is expected that globalisation trends will continue, and the social changes accelerated by globalisation will become increasingly important. However, it is important to acknowledge that socio-cultural traditions and historical contexts also have a significant impact in today's globalised world. This is particularly relevant in the area of caring for children and young people who are unable to grow up in a family environment. Our team conducted an international research study to investigate the institutional care environment in the Czech Republic and the Slovak Republic, which were previously united as Czechoslovakia. After the division, each state adopted its own approach to institutional care. Within a few decades, two distinct systems of institutional education emerged, with common starting points. However, over time, their views on institutional education became significantly more specific. The main objective of this paper is to explore both systems. The paper is divided into sections that address the situation in both the Slovak Republic and the Czech Republic. The current state of knowledge and methodology used will be presented. Common elements will be identified, and differences between the systems will be highlighted. This paper will be useful not only to professionals from the Czech and Slovak Republics but also to the special education community from other Central European countries.

2 Theoretical background

Contemporary research has primarily focused on investigating the consequences of abuse and other interpersonal traumas during childhood. However, there has been a significant lack of attention given to exploring the experiences of children who have been removed from their homes (Brady and Caraway 2002). Residential care is an important topic. Research consistently shows that individuals who have experienced foster or residential care tend to attain lower educational qualifications compared to the broader population (Little et al., 2005; Gypen et al., 2022; Sousa et al., 2023). The issue of residential care is a relevant social issue that requires better treatment in Czech and Slovak literature. Upon reviewing existing sources, it is evident that the situation in the Czech Republic is particularly concerning. Vocilka's work on children's homes, frequently cited, is outdated as it was published in 1999. The information provided is better suited for a historical account due to legislative changes. In contrast, Škoviera, a notable author in the Slovak Republic, has significantly influenced the view of institutional care not only in the Slovak Republic but also in the Czech Republic with their publication 'Dilemmas of Substitute

Care' (2007). The contributions of Mikloško (2020) and Labáth (2001) are acknowledged. Additionally, Szafranek's (2022) work, which examines foster care systems in Poland, the Slovak Republic, the Czech Republic and Great Britain, is inspiring. Novák (2013) has also written work that compares different systems. This paper references the research of Daněk (2022), Žolnová (2020) and Kaleja (2013).

3 Research methodology and research approach

The main research idea was to compare the Czech and Slovak systems of institutional care. We decided to carry out a qualitative research investigation, which was based on intensive contact with the researched environment. We did not base ourselves only on an academic perspective, but actively carried out a series of excursions to Slovak children's centres between April 2023 and December 2023 to conduct research activities. We had the Czech institutional environment covered with our long-term research activities. In contrast to a purely academic approach, which would have consisted in producing a paper based on theoretical information only, we had the unique opportunity to spend a considerable amount of time in both Slovak and Czech institutional settings and to base our research on the realities of the national educational realities under study. We employed a qualitative research design, a methodology that has demonstrated success in prior projects (Daněk 2022). We believe that a passive researcher may not achieve good-quality results compared to a researcher actively involved in the research context (Charmaz 2006). Intensive contact with the group being researched is important (Creswell 2009; Toušek 2015). Therefore, we tried to spend as much time as possible in the researched environments. Semi-structured interviews and simultaneous observation were used in the initial gathering of information. The information obtained was then processed by methods grounded in theory and interpretative phenomenological analysis. We have made thorough use of the principle of triangulation, which is a research method where our findings are subjected to the critical perspective of other research methods or other researchers (Flick 2009). The findings from the qualitative research were then placed in the context of the theoretical framework of individual systems of institutional education developed by other members of our research team.

4 Institutional childcare in Slovak Republic

This part of the paper will be devoted to the Slovak system of substitute institutional care. Parents have a duty to meet the biological, psychological, social and developmental needs of the child. If the parents do not fulfil their obligations, do not ensure the upbringing of the child and permanently live a disorderly life, set an unsuitable example for the child, their rights may be restricted or even suspended according to the provisions of the law (Act No. 36/2005 Coll., § 38). The Law defines substitute care as a number of specially arranged, interdependent, temporary measures that substitute for parental care (Act No. 36/2005 Coll., § 48). The forms of substitute care are the placing of a child in the personal care of a natural person other than a parent (substitute personal care), foster care and institutional care. Removal of a child from the family environment may be ordered by the authority for social protection of children and guardianship by a court decision.

Institutional care has the character of residential care. Institutional care was carried out in children's homes, which were renamed Centres for Children and Families as of 1 January 2019. According to Vocilka (2000), the most common reasons for placing a child in institutional care are a serious objective obstacle to care, such as death, execution of a sentence, or a subjective obstacle of the parents, which can include drug addiction, alcoholism, severe disability. Also name neglect, abuse, child abuse. We cannot forget the child's problems such as truancy, long-term criminal activity, drug experience. Social

and cultural changes have brought an increase in socio-pathological phenomena, which has negatively affected the upbringing of children. The absence of extracurricular activities for children has created room for rampant socially unacceptable activities of underage children. Children were in conflict with ethical, legal norms (Žolnová and Kečková 2020). The causes of problems in the upbringing of children are ascertained by the competent authorities, which, in accordance with Act No. 305/2005 Coll., are the authorities of social and legal protection of children and social curatorship, which are aimed at the protection of children's rights. The activities are of different nature, ranging from fieldwork, administrative social work, communication with courts, participation in offence proceedings, provision of professional assistance. Failure of parents in the upbringing and care of their child results in entrusting the child to substitute care.

Since the mid-1990s, the transformation of children's homes in Slovakia began. The main aim of the transformation of children's homes was to make children's homes a "transfer station", not a "final station" (Mikloško and Chovancová-Bezáková 2022). The mentioned transformation of children's homes included transformation of educational conditions, transformation of personnel structure, transformation of spatial conditions and transformation of economic conditions. The whole transformation of children's homes is aimed at making the environment of the children's home as similar as possible to the natural family environment and at preparing the child for independent life after leaving the home. The essence of this transformation is that the educational system in children's homes should be based on an individual approach to each child. It is also important to emphasise the training of professional parents and educators for the individual independent groups. It should not be forgotten that it is necessary to involve the child in the day-to-day care of the home, so that he or she is able to manage everyday activities such as shopping and preparing meals, and so that his or her life resembles that of the family as closely as possible. This was much more difficult to ensure in residential homes, but in a professional family or independent group the child could take a more active part in the daily running of the household. Support for the transformation of children's homes into models that are closer to the natural family is also being provided by changes in the spatial conditions of the housing. Separate groups are better placed in separate housing units. Education should be much more effective and efficient in a smaller group and in a smaller space. One to four separate groups in one building is optimal. Placing a separate group in a separate family home is probably the most advantageous. In this way, children have the opportunity to participate in the community life of a particular village or part of town.

The provision of institutional care, interim measures and educational measures in the children's home, currently referred to as the Centre for Children and Families, can be provided in two ways. In a professional family, which may carry out institutional care, interim measures or educational measures in a house or flat which is a defined part of the Centre, or in its own house or flat for a designated number of children. The second possibility of providing institutional care is in separate diagnostic groups which carry out professional diagnostics, in separate groups or specialised separate groups for a specified number of children, with separate catering, management and budget, set up in a separate house, flat or in a defined part of the Centre, a separate group for minor mothers with children, a specialised separate group with a specified specialisation and a separate group for young adults (Act No. 305/2005 Coll., § 51). Care for children in one group is provided by educators, a professional team consisting of a social worker, a social work assistant, a psychologist, a special educator, a therapeutic educator, an andragogist, a health worker, a physiotherapist, who carry out the social protection of children in accordance with the legislation. The Centre implements court orders by implementing measures in residential form, outpatient form, field form. It also develops and implements a specialised or resocialisation programme, a supervision programme, which may be combined with each other. Separate groups may also be

set up in satellite units, i.e. family houses or 5-6 room flats. The Centre may include a halfway house - a studio apartment, or a one-room apartment for young adults with a history of institutionalisation. It is important to emphasise that the implementation of institutional care, precautionary measures and educational measures in a professional family takes priority over their implementation in independent groups and in specialised independent groups.

The above-mentioned institutions are legislatively anchored by Act No. 305/2005 on Social and Legal Protection of Children and on Social Guardianship. In the system of institutional education of the Slovak Republic, an important role is also played by school institutions, which are legislatively established by Act No. 245/2008 Coll., the Act on Education and Training and on Amendments and Additions to Certain Acts, the so-called School Act. The school system includes special educational establishments. These institutions are a diagnostic centre, a re-education centre, a medical-educational sanatorium. Various types of schools are part of these Centres and Sanatoriums.

The diagnostic centre provides children with diagnostic, psychological, psychotherapeutic, educational care. It provides diagnostics to children with disturbed or endangered psychosocial development in order to determine further appropriate educational, re-socialization or re-education care. A child's stay in the diagnostic centre usually lasts twelve weeks. It is a residential establishment with continuous operation, which includes a primary school (Act No. 245/2008 Coll., § 120).

Re-education centre provides children with behavioural disorders from the age of 12 with education and training aimed at optimising their psychosocial development. A re-education centre is a special educational institution which, on the basis of an educational programme and an individual re-education programme, provides children up to the age of 18 years with the possibility of prolongation for one year with education and training, including preparation for a profession, with the aim of their reintegration into the family environment. The re-education centre accepts children of both sexes. For each child, it creates an individual re-education programme based on psychological and special-educational diagnostics (Act No. 245/2008 Coll., § 122).

The therapeutic-educational sanatorium provides psychological, psychotherapeutic care and education for children with developmental disorders for whom outpatient care has not led to correction. The basic organisational unit in special educational institutions is the educational group, which is established for a maximum of eight children. A child's stay in a sanatorium lasts between three and twelve months (Act No. 245/2008 Coll., § 123).

The admission of a child to the above-mentioned school institutions takes place on the basis of an application by the parents, an agreement with the institution in which the court decision is implemented, an interim measure of the court pursuant to a special regulation, a decision of the court on the imposition of an educational measure, an agreement with the institution in which the court decision is implemented, an interim measure of the court pursuant to a special regulation, a decision of the court on the imposition of an educational measure, a decision of the court on the ordering of constitutional care, a decision of the court on the ordering of constitutional care (Act No. 36/2005 Coll. § 37, § 54). A child may be placed in a Re-education Centre on the basis of a court decision on the imposition of protective care (Act No. 300/2005 Coll., § 102).

Special education facilities provide a comprehensive approach that includes therapeutic, educational, social, employment and legal approaches. The re-education process is a set of measures, procedures aimed at functional correction, improvement of behavioural functions. The basal task is to regain certain skills and to make the most of the child's potential. Such a process

systematically focuses on emotional, moral and social disturbance in children with conduct disorder, assuming that conduct disorder in terms of etiology has a multidimensional character (Kaleja 2013). The main tool for the education of children in the Special Education Institution is the daily routine and the evaluation system. The daily regimen provides stability and organization of the day with the fulfillment of responsibilities. The evaluation system is an auxiliary tool in children's self-regulation, teaching them what forms of behaviour are accepted and therefore desirable. In the re-education process, therapeutic elements are applied, which are the community, psychotherapeutic groups, individual group, diaries, autogenic training, work with parents. The connection with real life is realized by group walks, field trips outside the facility, stays with parents, part-time jobs outside the facility, the possibility of making phone calls, wearing personal clothes (Žolnová 2013).

The Slovak Republic has a system of institutional care based on two departments, the Department of Education and the Department of Social and Legal Protection of Children. The Department of Social and Legal Protection of Children is responsible for the Centres for Children and Families, while the Department of Education is responsible for special educational institutions. The restructuring process initiated in the 1990s in the Slovak Republic is bearing results. For example, the idea of professional parents has gained ground and has been supported in legislation by the Act on Professional Substitute Parents (Act No. 376/2022 Coll.).

5 Institutional childcare in Czech Republic

We will now turn our attention to the system of institutional childcare in the Czech Republic. If the child's upbringing or his/her physical, intellectual or mental state or his/her proper development is seriously endangered or impaired to such an extent that it is contrary to the child's best interests, or if there are serious reasons why the child's parents cannot provide for his/her upbringing, the court may also order institutional care as a necessary measure. It shall do so, in particular, where the measures previously taken have not led to a remedy. In doing so, the court always considers whether it is not preferable to entrust the child to the care of a physical person (Act No. 89/2012 Coll., § 971). Institutional care may be ordered for a maximum period of three years. If the grounds for institutional care continue, it may be extended, even repeatedly, for a maximum of three years before the expiry of three years from the date of its order. The court shall review the reasons for the duration of the institutional care every six months (Halířová and Sychrová, 2014).

Institutional care shall be carried out in educational establishments. Therefore, the fundamental legislation is Act No. 561/2004 Coll., the Education Act. The transfer of children within institutions for the performance of institutional and protective care is carried out through the courts, not on the basis of diagnostic stays as in the past. The activities of the institutions are regulated by the Act on the Execution of Institutional Care or Protective Care in School Institutions and on Preventive and Educational Care in School Institutions (Act No. 109/2002 Coll.). The details of the performance of institutional and protective care in school establishments are regulated by Decree No. 438/2006 Coll., which precisely defines the organisational procedures for the care of children in care. In accordance with the law, a public prosecutor is responsible for supervising compliance with the law in institutions. The State prosecutor may petition the court to impose or revoke institutional or protective care.

When a child is admitted to the facility, his/her documentation must be handed over. The child shall be informed of his/her rights and obligations, the organisation, regime and internal rules of the establishment. After an initial interview, the child is placed in an educational or family group. Children and adolescents are placed in diagnostic institutions, children's homes with school and educational institutions on the basis of court-ordered institutional care or imposed protective care. In

children's homes only on the basis of an order for institutional care. Another method is the interim measure ordered by the court on the basis of a petition from a child welfare authority, which is a quick solution to the child's situation. The interim measure includes a decision on the child's further residence, i.e. a relative, temporary foster care, an etopedic institution, a non-profit organisation, e.g. the Fund for Children at Risk.

On the basis of the amendment to Act No. 333/2012 Coll., amending Act No. 109/2002 Coll., as of 31 August 2017, diagnostic institutions do not accept children for voluntary stays on the basis of an agreement between legal guardians and the institution. Voluntary stays are facilitated by educational care centres, which have both outpatient and residential programmes. These centres have considerable preventive potential.

With the entry into force of Act No. 89/2012 Coll., Civil Code, there has been a change in the competences of diagnostic institutions. Nowadays, the court decides on the placement of children and adolescents with an order for institutional education, without prior stay in a diagnostic institute. Children are placed directly in children's homes, children's homes with schools, and juveniles in educational institutions. In diagnostic institutes or in other etopedic institutions, clients are sometimes kept for a disproportionately long time on the basis of a provisional order due to the congestion of the courts.

Children who have been ordered by a court to undergo institutional care or a provisional measure are placed in children's diagnostic institutes, diagnostic institutes for young people, children's homes, children's homes with school or educational institutions, or in institutions for children in need of immediate assistance. Children of foreigners are placed in facilities for children of foreigners. Children who have been ordered by a court to receive protective care may be placed in a children's diagnostic institute, in a diagnostic institute for young people, in a children's home with a school and in a correctional institute.

Protective care is always ordered by the court for children over the age of 15, i.e. minors who have committed a crime. Exceptionally, it may also be ordered for children over 12 years of age who have been given an exceptional sentence for a criminal offence. Here, protective care serves essentially as an alternative to imprisonment and may be ordered up to a maximum age of 18 years, extended to 19 years if necessary. Protective care is regulated by Act 109/2002 Coll., and other important legislation includes the Juvenile Justice Act (Act No. 218/2003 Coll.).

Institutional care in the Czech Republic can be carried out in a children's home, in a children's home with a school, in a correctional institute and also in a diagnostic institute. A children's home is a type of educational establishment used to provide residential care. Children between the ages of 3 and 18 are placed in the home and have the option of staying in the home until they have completed their education. The maximum age limit for staying in a children's home is usually set at 26 years. Children who are placed in children's homes may include minor mothers together with their children. The reasons for placing children in children's homes are situations where it is not possible to provide them with adequate upbringing through foster care or within their biological family. This may be due to various circumstances such as family problems, neglect, danger to the child, or other conditions that do not allow the child an adequate and safe environment. Children placed in children's homes live in the home but also attend external schools that are not part of the home itself. In this way, they have access to the mainstream education system and can participate in educational activities according to their needs and abilities. The aim is to provide these children with a stable and supportive environment that enables them to develop and complete their education, even when they are unable to live with their biological family (Act No. 109/2002 Coll., § 12).

A children's home with a school is a specific type of residential establishment that combines education with care for children who have been given institutional care, or who have been placed in protective care, or who are minors with children. This type of institution serves as an environment where comprehensive care and education is provided for specific groups of children whose life situations do not allow for adequate education in the conditions of a regular children's home. A specific feature of a children's home with a school is that it provides education directly within its facility. Children attend school directly in the home, which allows for careful coordination between the educational process and the overall care provided in the institution. In this way, children can continue their education even when it would be difficult or impossible to do so outside the children's home. Limiting the age of placement in a children's home with a school to between the age of 6 and the end of compulsory schooling ensures that children are adequately supported and monitored in their development in this environment throughout their basic education (Act No. 109/2002 Coll., § 13).

A correctional institute is an educational establishment for children over 15 years of age with serious behavioural disorders who have been ordered to undergo institutional or protective care. These are children whose behaviour is considered risky. Examples of serious risk behaviour leading to the transfer of a child to an educational institution include substance abuse, early sexual activity, delinquency, truancy or aggressive behaviour towards other people. In exceptional cases, a child over the age of 12 may be placed in an institution. This can happen if the child has been placed in protective custody and his or her behaviour is so risky that the individual cannot be placed in a children's home with a school (Act No. 109/2002 Coll., § 14).

A diagnostic institute is a residential educational facility that comprehensively examines children and young people from a psychological and pedagogical point of view. The Children's Diagnostic Institute is for children from the age of 3 until the end of compulsory schooling. The Youth Diagnostic Institute is for the age group from the end of compulsory schooling to 18 years of age, or for adults up to 19 years of age (Act No. 109/2002 Coll., § 5).

It is important not to forget the institutions operating under the Ministry of Social and Legal Protection of Children. The key legislative norm here is Act 359/1999 Coll., the Act on Social and Legal Protection of Children. This Act allows for the establishment of institutions for children in need of immediate assistance. However, the public often confuses these facilities with the previously mentioned school institutions. The Czech Republic is currently in the process of revising existing legislation, and we expect new laws regulating the implementation of institutional care in the near future that will reflect the current needs of society.

6 Researched systems from the perspective of practice

During our qualitative research in the environment of Czech children's homes and Slovak centres for children and family, we have noted several significant findings. Surprisingly, it turned out that both the Czech and Slovak professional publics do not have accurate information about the situation in the field of institutional care in the neighbouring country. The staff of Slovak centres for family and children are not familiar with the system of institutional care in the Czech Republic and vice versa. This would not be a serious fact in a situation in which there are efforts to significantly reform institutional care in the Czech Republic, and one of the arguments why the current Czech system needs to be modified are references to the Slovak system. From the Slovak system, reference is made to the new concept of professional parents and the fact that a significant part of institutional care in Slovakia is also under the responsibility of the education ministry is somewhat overlooked. We have also repeatedly encountered the claim that Slovak centres for children and families are social institutions, which is not true, because they are social protection institutions. The staff of the children's

centres themselves object to the designation of their workplaces as social services. What the Czech pedagogical staff of children's homes point out as a significant difference in the concept of the system of work with children at risk is the number of professional staff of the centres for children and family, such as social workers and psychologists, clearly defined by law. Whereas in the Czech children's home there is usually only one social worker who is mainly in charge of administrative matters.

At the same time, we noted important cultural specificities that are not much discussed when debating changes to the current state of institutional care. In interviews with professional parents at the Child and Family Center, there was repeated information that their religious beliefs played a significant role in their decision to begin this work. When we conducted interviews with Czech educators, the issue of religion appeared to be significantly less important than in Slovakia. In addition to the religious issue, different views on issues connected to the Roma minority emerged. During the discussion with Slovak colleagues, it turned out that it is very tricky to look at the issue of Roma integration into society with a similar lens in the Czech Republic and Slovakia. It was pointed out to us that the Czech Republic has no experience of working with children from socially excluded settlements, where conditions are diametrically opposed to those in the Czech excluded localities.

From what we have observed together in both states, professionals working in children's homes and child and family centres point out that their challenging work is often unappreciated by society.

7 Conclusion

In every society, there is a certain percentage of families that have considerable difficulty fulfilling their role (Fišer and Škoda 2014). Current research shows that children from these backgrounds are increasingly entering the institutional care system later, which also means with greater difficulties (Topinka and Topinkova 2023). If we consider the significant impact that the environment has on children during the early periods of development (Denham et al. 2014), we cannot be surprised. It is important to point out that every individual will leave the institutional environment one day. A number of research studies point to significant difficulties in the transition from residential care to mainstream life (Hägman-Laitila et al. 2022; Danek 2023; Dorothea 2023). This topic will require intensive research (Parry and Weatherhead 2014). There is a need to recognise that there is more to providing a child in an institution than simply a safe environment (Chase 2013). If we invest in the child, they are able to build functional emotional attachments (Kauhanen et al. 2022) which will then help them through the transition phase and after leaving the residential setting.

Our paper offered a view into two related systems of substitute institutional care. It turned out that both systems have specificities that we need to be clearly aware of. Although previously mentioned globalisation blurs borders, the issue of institutional care for vulnerable children needs to be based on local cultural and historical traditions. We see strengths and inspirations in both systems under review, as well as reserves. We are convinced that the way of the future is not uncritical adoption of foreign models, but mutual inspiration towards a common goal. To create a system of institutional care that can meet the demands of today's rapidly changing world, and most importantly, the needs of children and young adults who cannot grow up in their family environment.

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MOTIVATION FOR MILITARY SERVICE AS AN IMPORTANT COMPONENT OF HUMAN RESOURCES MANAGEMENT IN THE MINISTRY OF DEFENSE IN THE CZECH REPUBLIC

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Abstract: The paper focuses on the issue of motivation for military service in the Czech Armed Forces. It aims to map the Institutional-Occupational (I-O) motivations of the generation of Czech recruits currently starting their military career. The research sample consisted of 1557 recruits. Institutional preference was confirmed. The influence of gender, age, education, partner life and parenthood on these factors were also analyzed. From an institutional point of view, significant influence of age and education was found. From an occupational point of view, results showed, that again age, education and type of partnership cohabitation have a significant influence.

Keywords: Human Resource Management, Motivation, Recruit, Military Profession, Questionnaire Survey, ANOVA, Ordinal Regression.

1 Introduction

Sociological research represents an integral part of human resource management. Such research yields detailed information about the factors determining relationships between employers and employees. Organizations employing tens of thousands of people can thus obtain feedback from their employees as a tool to examine the impact of their decision-making, their aims and objectives, as well as related effects of a wide range of aspects (Hsu & Leat, 2011; Potocnik et al., 2021). Finally, yet crucially, sociological research allows leaders to receive further input from their employees. Motivation is critical for employees; the term comes from the Latin word *movere*. While “motive” is a reason to do something, motivation expresses the force and direction of behavior and includes factors that influence people to behave in a certain way. The earliest approaches to knowing and understanding motivation stem from Greek philosophers, for whom the pursuit of pleasure was considered the main driving force (Steers et al., 2004).

Gradually, the perception of motivation changed. In the 20th century, content-oriented theories (need theory) began to gain precedence, while in the second half of the century, theories focusing on processes and expectations emerged (Hunter et al., 1990). People are motivated when they expect that a particular action is likely to lead to achieving a goal and acquiring a valuable reward – one that satisfies their needs and fulfills their wants. Highly motivated people exercise voluntary behavior – they endeavor to make a greater effort and do something more. Such people can be motivated by themselves (Armstrong & Taylor, 2014, Bushi, 2021).

Similarly, if the Ministry of Defense of the Czech Republic intends to attract, retain, and develop professional military personnel, it is to follow a similar approach. The specifics of the military profession entail political, economic and security considerations, as well as moral and ethical aspects. This fact adds to the importance, necessity and need for proper evaluation of all these aspects. It is important for the Ministry of Defense to know the motivations for joining the service, perceptions of the military profession, military values, attitudes, opinions, and prestige of the military among the public.

The issue of human resources management in the Ministry of Defense of the Czech Republic is given considerable attention. This area is anchored in the strategic documents of the Ministry of Defense, especially in the White Paper of Defense (2011),

which was approved by the Government Resolution No. 369/18.5.2011, then in the 2030 Long-Term Defense Outlook (2015) and the 2025 Czech Armed Forces Development Concept (2019). Personnel management focuses on the recruitment of military and civilian personnel, their retention in service and employment. The research results in these areas are the basis for the discussion on the focus of the HR policy of the Czech Ministry of Defense. Such research contributes to feedback on strategic documents, priorities, critical tasks, and future changes.

2 The Current State of Motivation for Military Service: International Perspective

Motivations for joining the military have been systematically studied by experts since the 1970s. Researchers interested in studying why individuals engage in military service have often categorized the diverse set of motivators for enlistment via the analytical framework of Moskos' (1977) Institutional-Occupational Army Model (I-O model). Moskos has defined two different concepts of organizing the military – the Institutional and the Occupational military. The institutional military is legitimated in terms of values and norms that create a personal sense of obligation. Its members usually follow a calling, and the purpose of the armed forces transcends individual self-interest. Talking about world militaries, the institutional perspective reflects the intrinsic values, such as duty to country, desire to serve others, loyalty and commitment, discipline, honor, and patriotism (Moskos, 1977; Lawrence & Legree, 1996; Woodruff et al., 2006; Eighmey, 2006; Griffith, 2008).

On the other hand, the Occupational military is legitimated in terms of the labor market. From this perspective, military service is like any other civilian job. Soldiers serve in the military organization because of self-interest and extrinsic incentives such as monetary rewards, salary, benefits, enlistment bonuses, education funding, adventure and travel, job training or the chance of promotion (Moskos, 1977; Moskos, 1982; Woodruff et al., 2006; Griffith, 2008).

During the 1980s, Moskos (1986) argued that an all-volunteer forces would evolve from militaries driven by Institutional values to ones based on self-interested Occupational motivations. Stahl et al. (1980) found that job satisfaction and career orientation in Air Force personnel are positively associated with Institutional motivators and negatively correlated with Occupational motivators. Pliske et al. (1986) suggested that recruits enlist in the US Army for various economic and psychological reasons. Six distinct factors underlie recruits' enlistment motivations – self-improvement, economic advancement, military service, time out, travel, and education money. Similar components were found by Gade & Elig (1986), using data from the US Army's 1983 survey of high school graduates – self-improvement, education, escaping from civilian life and patriotism. Results of another research conducted by the US National Defense Research Institute show that enlistment is negatively related to an individual's academic ability, education finances, and employment opportunities (Antel et al., 1987).

During the 1990s, the most often mentioned reasons for enlisting, according to the Youth Attitude Tracking Study (YATS) from 1991, were job training and obtaining funding for further education. Other reasons frequently cited included duty to country, salary, and the opportunity to travel. Duty and training were more important for men, with women focusing more on educational benefits. High school graduates were most likely to mention educational benefits, while salary was cited more by those not in schools (Lerro et al., 1993). As for income level, although some research has found income entirely insignificant (Perry et al., 1991), other studies found that among young soldiers who enlisted for economic reasons, low income was positively associated with motivation (Lakhani & Fugita, 1993). According to another study, young people join the

military for material reasons but also for value-oriented reasons – duty to country, self-discipline, and leadership skills (Eighmey, 2006). Similarly, other studies found that intrinsic values such as patriotism and desire to serve still play a key role in the decision-making process to join the military (Woodruff et al., 2006; Park & Avery, 2016; Lewis, 2018). Segal & Segal (2004) found additional enlistment factors for the student population. Students with fewer educational prospects after high school have a higher propensity to enlist. Conversely, individuals who performed well during high school education and were children of college-educated parents were less likely to enlist. Finally, according to Gibson et al. (2007), parent attitudes are significantly related to the social pressure to enlist or not to enlist experienced by youth.

Data analysis from interviews with new active-duty recruits by Ginexi et al. (1994) revealed eight frequently mentioned motivations underlying recruit enlistment decisions. These motives were tradition-based interest (expressing a long-term interest in a military career, usually based on family history), self-improvement, job/professional training, money for education, groping, time out, escape, and no other jobs/perspectives.

The decision by an individual to join the military is complex and commonly motivated by several intrinsic and extrinsic factors (Ginexi et al., 1994; Lawrence & Legree, 1996). In an effort to describe and conceptualize what motivates individuals to enlist, military researchers have taken many approaches and often attempted to describe enlistment decision categories.

After 2000, several studies (Griffith, 2008, Griffith, 2011; Kleykamp, 2006) show that individuals are more likely to enlist in the military if they have a family member who did serve, or was currently serving, at the time of their enlistment.

In a separate study, Eighmey (2006) analyzed the service motivations of American youth through a series of surveys. He identifies seven themes related to youth enlistment – benefits, fidelity (desire to serve community and duty to country), dignity (pride in work, working in an environment free of discrimination), risk, family (approval/respect from family and friends), challenge, and adventure. Of those seven, fidelity, risk and family were identified as Institutional motivations. This finding is consistent with the assertion by Moskos (1986) that service members respond to both Institutional and Occupational motivations.

Griffith (2008) noted that institutionally motivated reservists reported greater levels of commitment (in terms of reenlistment intentions and reasons for reporting), acceptance of the demands of military service, and combat readiness. In a separate piece, Griffith (2009) argued that the importance of Institutional motives is particularly evident in an era when the military places more demands on reservists.

While the (I-O) model of militaries has been a useful analytical framework that has been extended to the study of individual-level enlistment and retention decisions, there may be differences in its applicability across the services (Mastroianni, 2006) across job specialties within the same branch of the service (Burland & Lundquist, 2013) and between the sexes (Eighmey, 2006). Mastroianni (2006) noted that, Army officers might have comparatively fewer Occupational motivators compared to Air Force officers. This might occur because Air Force pilots have lucrative opportunities in civil aviation while there is a comparative lack of attractive civilian opportunities for soldiering. Additionally, Stahl et al. (1980) found that Marine officers are less occupationally motivated than their peers in other services are. They attributed this to Marines placing special emphasis on their role as combat soldiers. In addressing intra-service positions, Burland & Lundquist (2013) noted that Occupational motivators were more prevalent in support functions, while Institutional motivators are prevalent in combat positions. They also found that as the length of military service grows, the motivational differences between occupations diminish. Finally, research results by Woodruff et al. (2006)

indicate that the Institutional – Occupational distinction is overly simplistic. Their principal component analysis yields four factors that explain enlistment motivation – Institutional, Occupational, future orientational (career and educational aspirations) and pecuniary (financial concerns).

Nakonečný (2014) argues that the concept of motivation describes the psychological reasons for behavior and its subjective meaning and also explains the observable variability in behavior, which is manifested in why different people are oriented towards different goals. He also supports the classification of recruit motivation as classified by Moskos (1977). Institutional motivation is legitimated in terms of values and norms, i.e., a purpose transcending individual self-interest in favor of a presumed higher good. On the other hand, Occupational motivation implies the priority of self-interest rather than that of the employing organization (Moskos, 1977).

Mankowski et al. (2015) interviewed 18 enlisted female service members and veterans and found that women joined the military for financial stability, job training, education, and employment opportunities. According to Grigorov's (2020) study, based on interviews conducted among 52 US and 11 Bulgarian servicemen, the most important factors for choosing a military career were participation in missions and operations abroad and opportunity to serve their country, which shows the role of patriotic upbringing. Other important reasons highlighted were career opportunities, opportunities to work with weapons and military equipment, free education, teamwork, and work in an international environment.

3 The Current State of Motivation for Military Service: Czech Prospective

The article "Conscripts and the Military Profession in the Czech Republic" examines the attitudes of Czech conscripts towards the military profession (Hodný & Sarvaš, 1999). It monitors their willingness to become professional soldiers. It found that when it comes to career motivation, majority preferred occupational incentives, while those who preferred institutional incentives represented a small minority. Conscripts identified outdated technology, the military mindset, and the low social prestige of the military profession in the Czech Republic as the main reasons that drove them away from a military career. A significant percentage of conscripts openly expressed racial and national intolerance. On the other hand, the article found that the military had the potential to calm these tensions and become an integrated institution contributing to racial and national understanding.

The Department of Expert Services for Human Resources (the human resources agency of the Czech Armed Forces), has launched a research initiative entitled "Motivation for the Military Profession" (2016 - 2023). In 2021, the Czech Ministry of Defense conducted a research Armed Forces and Society 2021 (Armáda a veřejnost 2021), aimed at finding out and analyzing the opinions of Czech citizens on the military, defense and security of the country.

Further studies aimed at motivation to further professional education and selected determinants of career development and management, both from the perspective of an individual soldier and from the perspective of the Czech Armed Forces. The obtained data made it possible to set the direction for the next steps of the research within the framework of an institution research project "Development of Social Competences of a Soldier-Leader" (Kubínyi & Veteška, 2017, Kubínyi et al., 2022).

The article of Holcner et al. (2021) presents an empirical analysis of the relationship between the recruitment of personnel in the Czech all-volunteers forces and selected economic indicators, including actual economic performance, the situation on the domestic labor market and the evolution of defense spending for the period between 2005 and 2019. The relationship between military recruitment and economic performance was examined here using GDP values and GDP dynamics (GDP

index). The general unemployment rate, the economic activity index, and the ratio of military to general average wages were used to analyze the relationship between military recruitment and the domestic labor market. The relationship between military recruitment and defense spending was examined based on the general defense burden (defense spending as a share of GDP), the defense burden of the state sector (defense spending as a share of state budget spending) and year-on-year changes in defense spending.

4 Data and Methods

The aim of the presented research (the 1st stage of a broader "Motivation for the Military Profession" project) is to survey recruitment and leadership decision-making among a new generation of recruits joining the all-volunteer Czech Armed Forces, based on an analysis of their attitudes, opinions and beliefs related to military service.

Regarding its theme and goal, the research was set in a quantitative paradigm. Questionnaire survey appears to be the most effective data collection technique for this purpose. The uniqueness of the project is that it represents a longitudinal panel study in which data has been (and even in the future will be) collected in several phases. In the first stage, data collection was carried out in seasonal runs of the Basic Training Courses, for soldiers joining the Czech military.

The presented first phase of the longitudinal research is based on a systematic sample of basic training courses. Every second basic training course within given period was selected to conduct the complete survey. For the selected courses, all course participants present at the training were interviewed. Great attention was paid to the administration of the paper and pen questionnaire; respondents were motivated to participate in the research (complete the questionnaire) by the personal presence of researchers who were not part of the chain of command and guaranteed independent analysis of the research data. Other specific conditions - bulk data collection at the end of the intensive induction course ensured a return rate of almost 100% (not completed by individuals only). The results are thus representative of the population of soldiers joining the Czech Armed Forces, the research population consists of 1557 recruits and the specifics of military organization made it possible to reach the entire population. Research Ethics: The purpose and objective of the research, the handling of the completed questionnaires, including full assurance of anonymity, were explained in detail to all research participants prior to data collection. At the same time, they were informed of the possibility to refuse to participate in the research at any time or to refuse to answer any single question.

Data collection was carried out from December 2016 to October 2018. The questionnaire survey was processed using a self-constructed technique; the target population consisted of professional soldiers at the very beginning of their careers (immediately upon their recruitment during their basic military training). The validity of the questionnaire was verified in a pre-survey conducted among incoming soldiers at a selected military unit in November 2016, some of the questions were taken from published civilian research (reference), some of them had been used in the research of the Expert Services Department for a long time and the validity and reliability is thus verified by previous results.

The importance of motives for career choice in general was measured by a 19-item closed-ended battery with responses on a Likert scale of very important, somewhat important, somewhat unimportant, and not important at all. For specific motives for choosing a military profession, respondents commented on a closed battery of 14 reasons for choosing a military profession where the items were dichotomous, yes - no. The distinction between Institutional and Occupational was also operationalized as agreement with the statement "State sovereignty must be defended at all costs." And the statement "Becoming a

professional soldier means taking on ethical or moral commitments."

In total, 1557 respondents were interviewed, 5% of them were female. Soldiers joining the Czech military were in 41% younger than 25 years, 46% were 25 – 33 years, and 13% were aged 34 and older. Two thirds of recruits had a partner, one fifth are parents. App. 30% of respondents joined the military with previous vocational secondary education, more than half (54%) were high school graduates, and another 13% had a university degree.

The research focuses on confirming or refuting hypotheses formulated below, that elaborate the above outlined general aim of the research:

- $H_{I/O}$: For joining the Czech Armed Forces, recruits perceive Institutional motivation statistically more significant than Occupational one.
- H_{inst} : Recruits perceive respect for law and order a statistically significant motive for joining the Czech Armed Forces.
- H_{occup} : Recruits perceive social security (regular pay, health care) a statistically significant motive for joining the Czech Armed Forces.

Institutional Motivation – Research Questions:

Twelve questions included in the questionnaire reflected Institutional factors of motivation, covering the following four areas of doing something useful for society, i.e., national security; having responsibility for national defense; respecting law and order; and liking discipline, military organization.

Respondents were further asked whether they agreed with the statements "national sovereignty must be defended at all costs" or "becoming a professional soldier means taking on certain ethical and moral obligations", and also, how important they rate power, family traditions, or recommendations from friends.

Occupational Motivation - Research Questions:

Twelve questions reflecting the Occupational factors of motivation were focused on the following seven areas: social security i.e., job security; good working conditions; opportunities for professional growth and career development; earning more money than in civilian professions; having a high standard of living; opportunity to learn foreign languages; and traveling/serving abroad.

For the purpose of statistical analysis of the questionnaire data and quantification of these factors (Institutional and Occupational), the responses to the questions related to these factors were recorded as follows:

- The value of 1 corresponds to the answers: yes; or very important, rather important; or strongly yes, rather yes; or strongly agree, rather agree.
- The value -1 corresponds to the answers: no; or insignificant, rather insignificant; or definitely not, rather not; or strongly disagree, rather disagree.
- The value 0 corresponds to the answer "cannot judge" or to missing observations.

This "precoding" of the answers may lead to a loss of some (more detailed) information. But on the other hand, it suppresses the subjective perception of the scales. Without this aggregation, the analysis of the total score, which is the sum of the answers to the different types of questions, would not be possible. The total score is then the sum of these values. Each respondent's score for the Institutional and Occupational factors was determined in this way. Thus, the minimum possible value is -12 and the maximum possible value is 12.

The frequency analysis of data from the questionnaire survey was performed using the Remark Office OMR software, SPSS version 22.0 (Statistical Package for the Social Sciences). The following statistical methods were used for the analysis of the

scores (Institutional and Occupational): Wilcoxon test, ANOVA, ordinal regression analysis. The calculations were performed in the statistical environment R.

The Wilcoxon test and analysis of variance belong to standard statistical methods, which are detailed in many statistics textbooks, see e.g. Devore (2012). So, we will only briefly describe the ordinal logistic regression model (Harrel, 2001).

Assume that Y is an ordinal random variable that has J categories. Let us define the odds ratio

$$\frac{P(Y < j)}{P(Y \geq j)} \tag{1}$$

for $j = 1, \dots, J - 1$. We define an ordinal regression model for the logarithm of the odds ratio as

$$\log \frac{P(Y < j)}{P(Y \geq j)} = \beta_{j0} - \beta_1 x_1 - \dots - \beta_k x_k, \tag{2}$$

where x_1, \dots, x_n are regressors.

5 Results and Discussion

Values of scores for Institutional factors are demonstrably higher than the values of scores for Occupational factors, see Table 1, 2 and Figure 1 (mean of Institutional scores is 9.2, median 10, mean of Occupational scores is 5.4, median 6, p-value of Wilcoxon test is 0).

Tab. 1: Frequency table of scores

Score	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1
Institutional	0	0	0	3	0	4	6	1	10	10	22
Occupational	2	0	0	5	4	4	9	5	12	22	59
Score	2	3	4	5	6	7	8	9	10	11	12
Institutional	13	33	20	52	27	111	70	368	156	255	389
Occupational	63	150	136	299	211	262	202	41	20	23	21

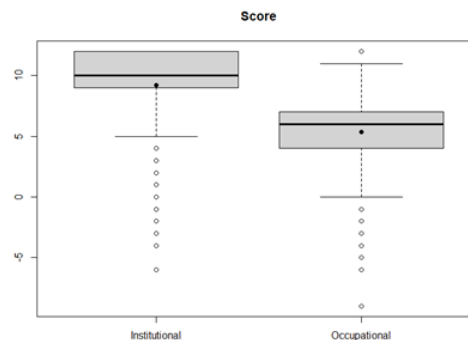
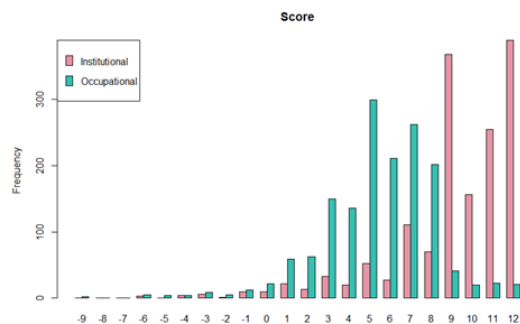
Source: author's calculation.

Tab. 2: Descriptive statistics of scores

	N	Mean	Sd	Median	Min	Max
Institutional	1550	9.205	3.015	10	-6	12
Occupational	1550	5.375	2.742	6	-9	12
	Q _{0.25}	Q _{0.75}	Skew	Kurtosis		
Institutional	9	12	-1.747	3.697		
Occupational	4	7	-0.803	2.365		

Source: author's calculation.

Figure 1: Institutional and Occupational scores



Source: author's calculation.

An important motivation in general is the opportunity to learn foreign languages and travel/serve abroad. The least frequently mentioned are the effort to avoid unemployment and the fact that the responder has a soldier in his/her family. The results are consistent with results of previous research (Mankowski et al., 2015; Barr, 2016; Holcner et al. 2021).

In general, values related to responsibility, conformity and autonomy prevail among respondents. Younger age categories are significantly more likely to hold utilitarian values such as having a high standard of living or wielding power and influence. For women in general, helping the socially vulnerable is significantly more important than for men (80% vs. 64%), as well as respect for people with different views (90% vs. 84%). Those respondents who considered the threat of a military or terrorist attack within the next three years to be very unlikely felt lower responsibility for national defense.

Nearly 98% of recruits are proud to be citizens of the Czech Republic, with 71% choosing the answer "definitely yes." Pride in citizenship proved to be strongly related to respondents' sense of responsibility for national defense and security and to their level of conformity.

The military profession is often perceived as a profession for life. These recruits are prouder to be a soldier than average. Recruits who have a soldier in the family are more satisfied with their future appointment. Almost all (99.6%) graduates of the basic military training course are proud of the profession of a professional soldier, with 4 out of 5 respondents choosing "definitely yes". App. 57% of recruits are also proud of the military uniform, for about a third of respondents, the uniform is a working garment like any other, 5% of recruits feel uncomfortable in it.

When presented with the option to reenlist, the vast majority (97%) would do so, with 74% expressing a strong inclination and a quarter more indicating they were likely to do so. 80% recruits would recommend joining the military to a friend or family member; Only 6% of the respondents would not recommend the profession of a soldier directly, the rest chose the "other" option, mostly adding that it would depend on the person considering joining the military. More than 75% of respondents would like to serve in the military beyond the contracted period of military service.

More than 80% of recruits joining the Czech military were satisfied with their future job (appointment). Approximately 12% were dissatisfied, 8% had no idea about their future job.

From different prospective, research results are similar to those published earlier (Holcner et al, 2021). The perception of the military profession is in line with the aforementioned motives of the respondents to become a professional soldier – it is most often perceived by the respondents as the opportunity to ensure social stability, they saw it as an opportunity for career advancement. Opportunities for career advancement were significantly more common for college-educated men joining the

Czech military (69%). They, on the other hand, were less likely to consider the military profession as a service to the nation (35%) compared to recruits who joined the Czech military with lower than university education (44%). For female recruits with lower than university education, military service more often represented a vocation for a lifetime.

The effect of covariates on the scores will be analyzed using a linear model (ANOVA) with the variables determining the type of score (Type), gender (Sex), age category (Age), level of education (Education), partner relationship (Partner) and whether the respondent has a child (Parenting) (Barr et al., 2016).

$$SCORE = \beta_1 + \beta_2 Type + \beta_3 Sex + \beta_4 Age + \beta_5 Education + \beta_6 Partner + \beta_7 Parenting + \epsilon \quad (3)$$

Tab. 3: Analysis of variance table

	Df	Sum Sq	Mean Sq	F	p-value
Type	1	11199	11199	1368.69	0 ***
Sex	1	4	4	0.48	0.48844
Age	5	143	29	3.491	0.00377 **
Education	3	232	77	9.443	3.29·10 ⁻⁶ ***
Partner	1	3	3	0.369	0.54368
Parenting	1	1	1	0.79	0.67213
Residuals	3045	24915	8		

Note: p-value · p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001
Source: author's calculation.

The Table 3 above shows that gender, partner relationship and whether or not the respondent has a child are not statistically significant. We therefore perform a model reduction.

$$SCORE = \beta_1 + \beta_2 Type + \beta_3 Age + \beta_4 Education + \epsilon \quad (4)$$

Tab. 4: Analysis of variance table (reduced model)

	Df	Sum Sq	Mean Sq	F	p-value
Type	1	11300	11300	1377.223	0 ***
Age	5	142	28	3.65	0.00399 **
Education	3	232	77	9.405	3.48·10 ⁻⁶ ***
Residuals	3058	25091	8		

Note: p-value · p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001
Source: author's calculation.

Tab. 5: Estimation of parameters (reduced model)

	Estimate	Std. Error	t-test	p-value
(Intercept)	7.150	0.095	75.255	0 ***
Institutional	1.919	0.052	37.111	0 ***
Occupational	-1.919	0.052	-37.111	0 ***
Age 18–21	-0.0116	0.126	-0.092	0.9267
Age 22–24	0.180	0.101	1.784	0.0746
Age 25–27	0.156	0.104	1.5	0.1338
Age 28–30	-0.178	0.126	-1.418	0.1564
Age 31–34	0.252	0.151	1.664	0.0962
Age 34 and more	-0.398	0.130	-3.06	0.00223 **
Edu. secondary prof.	0.520	0.116	4.498	7.13·10 ⁻⁶ ***
Edu. secondary prof.	0.006	0.107	0.052	0.9586
Edu. higher prof.	-0.277	0.246	-1.128	0.2593
Edu. university	-0.248	0.138	-1.795	0.07281

Note: p-value · p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001
Source: author's calculation.

The estimated value of Intercept corresponds to the unweighted average of the scores for the unit groups created by sorting by the categorical variables Type, Age and Education. This shows

that type Institutional increases the value of the scores by 1.919, while Occupational decreases it by the same value. In terms of age category, there is a statistically significant positive effect for the category "34 and older", at the 0.10 significance level there is a positive effect for the category "22-24" (0.180) and for the category "31-34" (0.252). In terms of education, it can be said that for respondents with a secondary education there is a significant positive effect of Occupational (0.520), for those with university education the effect is negative (-0.248) however significant only at the 0.10 level.

For example, let's take a man aged 23 with a college degree. Then we would expect him to have the following values:
Institutional score: 7.150+1.919+0.180-0.248=9.001;
Occupational score: 7.150-1.919+0.180-0.248=5.163.

As mentioned above, the research results are dominated by the Institutional aspects. Among Institutional motivation factors the one indicated by the responders as the most important is the respect for law and order. It is followed with:

- Becoming a professional soldier means taking on certain ethical standards;
- Pride in the status of a soldier;
- Pride in the citizenship of the Czech Republic;
- Having responsibility for the defense of the country;
- Taking part in providing national security;
- Doing something useful for society;
- Will to do something for the security of my country;
- The sovereignty of the state must be defended at all costs;
- Ability to give my life for my country;
- Interest in doing useful work; and
- Liking order, discipline of the military organization.

Respondents proved their interest in supporting security of their homeland, which corresponds with results of previous surveys (Grigorov, 2020), and highlighted military profession related ethical and moral obligations. On the other hand the least important for them is power, family tradition or recommendations from friends. Compared to similar surveys from the period of 1999-2002, respondents laid more emphasis on professional development, self-realization, usefulness, and adventure. Power or family tradition became less important for them.

Considering the Occupational factors (O), when choosing their profession, respondents declared to consider primarily social security – employment security (regular salary, health care) and opportunities for professional growth and career development. Based on relative importance indicated by the responders, these factors are followed with good working conditions, self-realization, interest in working with military equipment, earning more money than in civilian professions and having a high standard of living, have the opportunity to learn foreign languages and, travel/serve abroad. These findings are consistent with previous research (Moskos, 1977; Woodruff, Kely & Segal, 2006; Griffith, 2008, Mankowski et al, 2015; Barr, 2016) and are also supporting the conclusion that recruits respond not only to the Institutional factors but also to the Occupational ones (Segal, 1986).

A detailed picture of responders perception of the most important Institutional motivation factor – respect for law and order offers an ordinary logistic regression model, using the following 4 categories: 1 = completely unimportant, 2 = rather unimportant, 3 = rather important, 4 = very important (see the Table 6 below).

Tab. 6: Ordinal logistic regression – Institutional – Respect for law and order – Motive Relative importance

	Value	Std. Error	t-value	p-value	
age 22–24	0.173	0.168	1.033	0.30173	
age 25–27	0.482	0.175	2.751	0.00594	**
age 28–30	0.626	0.199	3.141	0.00168	**
age 31–33	0.938	0.240	3.900	9.61·10 ⁻⁵	***
age 34 and more	1.423	0.239	5.965	2.44·10 ⁻⁹	***
completely unimportant rather unimportant	-5.813	0.589	-9.864	5.95·10 ⁻²³	***
rather unimportant rather important	-3.597	0.226	-15.901	6.2·10 ⁻⁵⁷	***
rather important very important	-0.302	0.133	-2.268	0.02333	*

Note: p-value · p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001
Source: author's calculation.

Based on the estimated parameters, we obtain the model described by equations (5) to (10). In the resulting model, we include estimates that are statistically significant at least at the 0.10 significance level.

$$\log \frac{P(Y < 1)}{P(Y \geq 1)} = -5.82 - 0.48age2527 - 0.63age2830 - 0.94 age3133 - 1.42age34 \quad (5)$$

or

$$\frac{P(Y < 1)}{P(Y \geq 1)} = e^{-5.82 - 0.48age2527 - 0.63age2830 - 0.94 age3133 - 1.42age34} \quad (6)$$

We estimate the odds ratio that completely unimportant is chosen relative to rather unimportant + rather important + very important, see equations (5) and (6). That means that if the exponent on the right-hand side is positive when e^x > 0,

then completely unimportant is a more likely choice than rather unimportant + rather important + very important. If e^x > 0,

the opposite is true, which will be our case. The value -5.81 corresponds to the age group 18-21. The parameters in the table show how the odds ratio is affected by age levels just relative to the 18-22 group. The effect of the 22-24 group is not significant, only other (higher) age categories are significant, these coefficients increase. This can be explained by the fact that with increasing age respondents are more likely to choose rather unimportant + rather important + very important than completely unimportant. Similarly for the remaining equations.

$$\log \frac{P(Y < 2)}{P(Y \geq 2)} = -3.60 - 0.48age2527 - 0.63age2830 - 0.94 age3133 - 1.42age34 \quad (7)$$

or

$$\frac{P(Y < 2)}{P(Y \geq 2)} = e^{-3.60 - 0.48age2527 - 0.63age2830 - 0.94 age3133 - 1.42age34} \quad (8)$$

Equations (7) and (8) describe estimates of the logarithm of the odds ratio, or the odds ratio of choosing completely unimportant + rather unimportant relative to rather important + very important.

$$\log \frac{P(Y < 3)}{P(Y \geq 3)} = -0.30 - 0.48age2527 - 0.63age2830 - 0.94 age3133 - 1.42age34 \quad (9)$$

or

$$\frac{P(Y < 3)}{P(Y \geq 3)} = e^{-0.30 - 0.48age2527 - 0.63age2830 - 0.94 age3133 - 1.42age34} \quad (10)$$

Equations (9) and (10) describe the estimation of the log odds ratio, or the odds ratio of choosing completely unimportant + rather unimportant + rather important relative to very important. For all 3 regressions the exponent is negative. As age increases, the values of the parameters increase, so respondents tend to have more positive ratings with older age.

To further analyze perception of the most important Occupational motivation factor – social security (regular pay, health care) a model is described in the Table 7 below.

Tab. 7: Ordinal logistic regression – Occupational – Social security (regular pay, health care) – Motive Relative importance

	Value	Std. Error	t-value	p-value	
age 22–24	0.330	0.191	1.725	0.08455	.
age 25–27	0.461	0.204	2.264	0.02357	*
age 28–30	0.326	0.228	1.433	0.15197	
age 31–33	0.496	0.273	1.817	0.06925	.
age 34 and more	0.239	0.236	1.015	0.31013	
education secondary	-0.239	0.147	-1.626	0.10402	
education higher prof.	-0.444	0.387	-1.148	0.25086	
education university	-0.510	0.205	-2.486	0.01291	*
partner with partner	0.311	0.132	2.359	0.01834	*
completely unimportant rather unimportant	-4.653	0.355	-13.120	2.51·10 ⁻³⁹	***
rather unimportant rather important	-3.243	0.240	-13.501	1.55·10 ⁻⁴¹	***
rather important very important	-0.958	0.197	-4.873	1.1·10 ⁻⁶	***

Note: p-value · p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001
Source: author's calculation.

The significant regressors for this question are age, education and partner. Constant members correspond to age 18-22, secondary vocational education, and status without partner. At the 0.05 significance level, only the 25-27 age category is significant, and at the 0.10 level, the 22-24 and 31-33 categories are also significant. The coefficients for age are positive (similar to the previous question), so there is a tendency to choose more "positive" answers compared to the 18-21 age group (Antel et al., 1987). However, unlike the previous question, the parameter values do not increase with age. The situation is different with education. Here the coefficients are negative, decreasing with increasing education. However, only the coefficient for university education is statistically significant. Thus, it can be said that with increasing education, respondents tend to make more "negative" choices. Respondents with a partner vote more "positively" than respondents without a partner.

The equations describing the estimates of the logarithm of the odds ratio or odds ratio are constructed analogously to the Institutional question using the estimates in Table 7 and equation (2). We include in the resulting model estimates that are statistically significant at least at the 0.10 significance level.

$$\frac{P(Y < 2)}{P(Y \geq 2)} = e^{-4.65 - 0.33age2224 - 0.46age2527 - 0.50age3133 + 0.24university - 0.31with.partner} \quad (11)$$

$$\frac{P(Y < 3)}{P(Y \geq 3)} = e^{-3.24 - 0.33age2224 - 0.46age2527 - 0.50age3133 + 0.24university - 0.31with.partner} \quad (12)$$

$$\frac{P(Y < 4)}{P(Y \geq 4)} = e^{-0.96 - 0.33age2224 - 0.46age2527 - 0.50age3133 + 0.24university - 0.31with.partner} \quad (13)$$

6 Conclusion

The presented research confirmed that the general motive for choosing a military career in the Czech Armed Forces is (according to Moskos' model 1977, I-O) based on more importantly on Institutional factors. However, Occupational factors have also confirmed their importance.

Identifying appropriate resources for military recruitment is an important part of managing the human resources of a military organization. The goal is to reach motivated candidates and call them into service. Military professional identified with the goals, visions, and tasks of the organization, perceiving positive elements of the organization's culture, is interested in the quality of his/her service, but also in influencing the results of team members, supports the activity of others and is interested in further self-education and cooperation with other members of the unit. The research presented here is unique because it identifies the motives of applicants immediately after they are called into service. Respondents' attitudes and opinions were not influenced by other factors because the data collection occurred immediately after their enlistment during basic military training. Results of the data analysis confirm the fact that the Institutional factors dominate for joining the military, but also show the importance of the Occupational factor (Moskos, 1977). Results of the research show how it is possible to monitor both sets of these factors and plan resourcing to them; knowledge of the motivational factors is also important for targeting potential sources of recruitment.

Recruiting and retaining the necessary personnel is and will be a critical factor for the Czech Armed Forces in achieving and maintaining the required capabilities necessary to accomplish the assigned missions and tasks. Therefore, one of the measures that can positively influence the potential of achieving the recruitment targets mentioned in the above-mentioned documents is the identification of the decisive factors of motivation of potential recruits for joining the professional Czech Armed Forces.

On the contrary, the results of the research did not confirm that the motivation to join the Czech military would be based on the intent of recruits to avoid their unemployment.

To summarize findings presented above, we can conclude that results of the research confirmed the hypotheses:

- $H_{1.0.}$: For joining the Czech Armed Forces, recruits perceive Institutional motivation statistically more significant than Occupational one – CONFIRMED. Newly recruited soldier in the Czech Armed Forces confirmed that for their decision to join the military Institutional factors play a more important role. On the other hand,

Occupational ones have their relevance as well, although not of the primary importance.

- $H_{inst.}$: Recruits perceive respect for law and order a statistically significant motive for joining the Czech Armed Forces – CONFIRMED. Among Institutional factors, recruits indicated respect for law and order as the most significant one. As detailed analysis of survey results show, recruits with older age perceive this factor more important than the younger ones.
- $H_{occup.}$: Recruits perceive social security (regular pay, health care) a statistically significant motive for joining the Czech Armed Forces – CONFIRMED WITH RESERVATIONS. This factor has been indicated by the responders as the most significant one among Occupational factors. This factor proved to be more significant for recruits with older age. On the other hand, as education recruits increases, respondents tend to indicate its lower relative significance. Similarly, respondents with a partner indicate this factor as more significant than those without a partner.

Results of the first stage research will be used for the follow-up stages. Longitudinal panel study may yield additional effects in the form of changes and differentiations. The global Covid-19 pandemic and the war in Ukraine as well as emerging economic problems may also have a significant impact, changing existing attitudes and preferences in the labor market. In these uncertain times, employers come to the fore, providing employees with social security.

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CASH FLOW RETURN ON INVESTMENT (CFROI) – METHOD OF MEASURING BUSINESS PERFORMANCE IN ENTERPRISES WITH HIGH INVESTMENTS

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Abstract: The paper aims to identify the essential factors affecting CFROI (based on a comparative analysis of theoretical sources, case studies and conclusions from our research) with a subsequent analysis of the implementation process of this method. The consequence of the connection is the systematic, holistically incorporated principles of the method into managers' decision-making. The procedure for applying the CFROI method consists of eight parts, namely data collection, determination of the value of depreciated assets and their useful life, calculation of the value of depreciated assets at current prices, calculation of the value of non-depreciated assets, determination of the value of the investment, quantification of cash flow, calculation of the CFROI indicator and its economic interpretation.

Keywords: Cash Flow Return on Investment, Performance in Enterprises

1 Introduction

The existence of any business depends on its success in the market, on the constancy of customers, on achieving set results and ultimately on competitiveness. The mentioned facts can be monitored in the business environment through performance. The enterprise can find out its current and prospective picture by implementing performance evaluation methods. Modern methods of performance evaluation include Economic Value Added (EVA), Market Value Added (MVA), Shareholder Value Added (SVA), Return on Net Assets (RONA), Cash Flow return on Investment (CFROI) and Cash Return on Gross Assets (CROGA). The mentioned methods provide an insight into the enterprise's performance from various areas of business activity. When deciding on their use, it is necessary to pay attention to their informativeness and to the ability to apply them to specific business conditions since not all modern methods can be applied to every business. These methods are often the result of several operations, which in many cases are difficult to calculate and time-consuming. Among the modern performance evaluation methods, Cash Flow Return On Investment (CFROI) has an essential position in investment-intensive production enterprises. It is challenging to implement in business practice but has good reporting ability. It is based on the principle of internal rate of return. A significant advantage is that the value of the invested property is not distorted by accounting depreciation and inflation. To quantify the operating return on investment, it is necessary to perform several calculations, thanks to which accounting data will be modified, and at the same time, individual indicators will be obtained, which will be used for the final quantification of CFROI. The CFROI indicator focuses on the ability of the monitored enterprise to evaluate its invested funds in the business. The operational return on investment expresses the operational performance of the enterprise's activity, which the enterprise would have achieved if, without additional investments, it had generated an operating cash flow in the same volume as it achieved in the monitored period during the lifetime of the operating assets. CFROI represents the enterprise's internal rate of return on existing investments, which is based on actual cash flows. In general, based on its comparison with the actual cost of capital, the enterprise can assess the quality of the investment. Reverse cash flow on investment helps determine the enterprise's return on investment, where the return must be greater than the cost of capital. Only in this case can the operational return on investment be considered positive. This concept also suggests that share prices in stock markets are set based on cash flows rather than earnings or business performance.

2 Literature review

By evaluating the performance, the enterprise can reveal faulty processes or procedures that prevent the improvement of the performance of individual processes as well as the enterprise as a whole. Increased emphasis is placed on the performance management of internal processes. Shareholders and managers are more oriented on long-term development and prosperity instead of orientation on short-term revenue achievement (Sujová, 2013). The business strategy is revised towards more sustainable production methods, business processes, resource efficiency, waste disposal, partnership building and communication efficiency (Hitka et al., 2019). Performance evaluation determines the efficiency of the production process but also the quality of the work of the employees who participate in this production process.

Authorized qualified enterprise management employees carry out performance evaluations. According to Ližbetinová et al. (2020), the ability to use human resources effectively is a key factor. According to Camaj et al. (2020), the need to estimate the consequences of investment decisions and the effort to penetrate the laws of investment processes lead to the development of analysis of investment decisions and the gradual discovery of factors that have the greatest impact on the future efficiency of investment. Decision-making about investments in an enterprise is related to the level of education and subsequent financial literacy, which is one of the most important competencies of individuals living in a modern global society (Kozubíková, 2016). Decisions require flexibility to respond to market demands, so managers need a flexible information system with a high-quality selection of information (Chodasová & Tekulova, 2016). These relationships should lead to efficient business. For all stakeholders involved, it means achieving maximum results with minimum investments (Prusa et al., 2020).

It is possible to use classic and modern methods of evaluating the enterprise's performance, from the simplest procedures based on cost criteria to traditional methods (payback period, profitability) to methods that consider the time factor (Chovancová et al., 2017). Classic performance measurement methods are mainly based on profit maximization as the basic goal of business. They use a large number of often incompatible ex-post and ex-ante analysis indicators to express the goal. The shortcomings of classical methods are primarily the respect of accounting data and the accounting result of management, failure to take into account risk, the impact of inflation, the time value of money, influencing the profit by the used valuation techniques, the creation of reserves and provisions, the depreciation policy, the accrual of costs and revenues. The shortcomings of traditional performance indicators stem from their exclusive focus on accounting data and do not consider the impact of the market on the value of capital. More and more often, classic methods of measuring business performance are insufficient, and it is necessary to turn to new modern ones that have a higher informative value. The substantial criteria during the assessment are represented by the amount and return on investment but also by qualitative criteria, (Malichová, 2018). They consider the risks arising from business, are largely linked to share value methods, use opportunity costs, and cash flow when measuring. According to the study by Deari et al. (2022), is the use of cash flow ratio to develop the analysis firms by dividing them as healthy and unhealthy. The enterprise is affected by current market trends such as globalization, rapid scientific and technical progress, expansion of enterprises into new markets, and changes in enterprise management. Modern trends cannot avoid the measurement and evaluation of business performance. According to Chodasová et al. 2015, at the same time, these requirements are related to the requirements for the organization of production and its management. Modern methods try to connect all the activities of the enterprise and its

participants to increase the value of the funds invested by the enterprise's owners.

In their research, the authors Malichová and Mičiak (2018) say that 85% of IT enterprises and 88% of industrial enterprises use profitability indicators while appraising the investment variants. The payback period of the investment is used by up to 92% of IT enterprises and by up to 81% of the industrial ones. When focusing on the other evaluation methods of investment efficiency, denoted as dynamic methods, a strong difference can be observed in the use compared with the static evaluation methods. The category of economic profit is implemented in the indicators, which takes into account, in addition to current costs, the so-called opportunity cost of capital, which represents the business owner's untapped investment opportunities that carry the same risk as the business.

The advantages of modern methods of evaluating the enterprise's performance are primarily that the basis of their quantification is the adjusted accounting value to the market value (use of the current price), they are oriented to the market value of the enterprise's shares (shareholder value), they take into account risk and the share of capital components in their total volume. The authors Maříková and Mařík (2005) claim that a modern indicator should also be linked to all levels of business management, support value management, evaluate performance, and at the same time, allow the valuation of the business and take into account only the main activity of the business when measuring. According to the author Hitka (2019), the business strategy is being revised towards more sustainable production methods, business processes, resource efficiency, waste disposal, partnership building, and communication efficiency. According to research by the author Rajnoh (2013), a modern performance indicator should enable the use of as much information as possible provided by accounting, calculate with risk and take into account the extent of committed capital, enable a clear and transparent identification of the link to all levels of enterprise management, enable performance evaluation and at the same time valuation of the enterprise. The efficiency of an investment project is usually evaluated via four fundamental indicators: net discounted income, profitability index, the payback period of investments, and internal rate of return on investment. Still, one of the most effective means to assess the effectiveness of an investment is the net present value (NPV), the total amount of discounted net cash flow received during the study period (Hoshovska, 2023). The Cash Flow Return On Investment (CFROI) method has significant explanatory meaning for manufacturing enterprises.

Decision-making plays a significant role in enterprises' future success and competitiveness in investment. (Malichová and Mičiak, 2018). CFROI can evaluate the internal rate of return on existing investments based on cash flows. Because free cash flow greatly impacts value, managers and investors can use FCF and its components to measure a enterprise's performance. (Brigham, 2014). Its significant advantage is in the use of the value of the property without its distortion by inflationary effects and accounting depreciation. During the calculation, it is necessary to carry out a larger number of calculations to quantify the operating return, due to which it is possible to arrive at the adjustment of accounting data and obtain individual indicators for the resulting quantification of the operational return on investment. Jacková (2021) states that the indicator expresses financial performance, similar to the ROA (Return on Assets) indicator for the enterprise, regardless of the financing structure. The conceptual difference between ROA and CFROI is that CFROI is based on cash flows, and ROA is based on profit or loss. The value of Cash Flow Return On Investment mainly depends on the expected net cash flow in the future, converted to a present value using a discount rate that reflects investors' profitability expectations. This model works exclusively with real values - values adjusted for inflation. Thanks to this, it is possible to compare the performance of the given enterprise over time, but also the performance of the enterprise in different countries. (Pavelková and Knápková, 2009). It was necessary to determine the individual values of the indicators of the lifetime

of the assets, non-depreciated assets, the value of the investment and the gross monetary formula. Subsequently, they can be used in the calculation of the CFROI indicator.

3 Materials and Methods

The paper contribution results from identifying the problem, which is the concern of managers to use methods that are difficult to collect and process data. The CFROI method belongs to the methods in which it is necessary to perform a series of calculations in sequence. Previous research revealed that even though the principles of the CFROI method are applied in enterprises, they need to be systematically and holistically processed. The paper aims to identify the essential factors influencing the CFROI, followed by an analysis of the implementation process of the CFROI method. The consequence of the connection mentioned above is the systematic, holistically incorporated principles of the method into managers' decision-making process. The primary basis for achieving the goal was the implementation of a comparative analysis of theoretically processed documents from modern methods of measuring business performance and case studies. Additional data were obtained from the implemented implementation of the eight parts of the method. The chosen form of quantitative research was based on the need for financial data obtained from the financial statements and internal records of a specific investment-intensive enterprise. In order to track developments over time, the processed data covers the period from 2019 to 2022. The CFROI method is complicated due to the determination of data groups, namely the value of depreciated assets, the useful life of depreciated assets, the value of depreciated assets at current prices, the value of non-depreciated assets at current prices, the value investments, cash flow, calculation of the CFROI indicator. The essence of the CFROI indicator is calculating the internal revenue percentage. Performance measurement at CFROI can be understood as an estimate of the real rate of return on all the company's assets. It can be calculated using the following relationship:

$$CFROI = IN - \sum_{t=1}^n \frac{CF_n}{(1+i)^t}$$

where:

CFROI (Cash Flow Return On Investment) - operational return on investment

IN – capital expenditure, gross value of the investment

i – interest rate, or internal rate of return

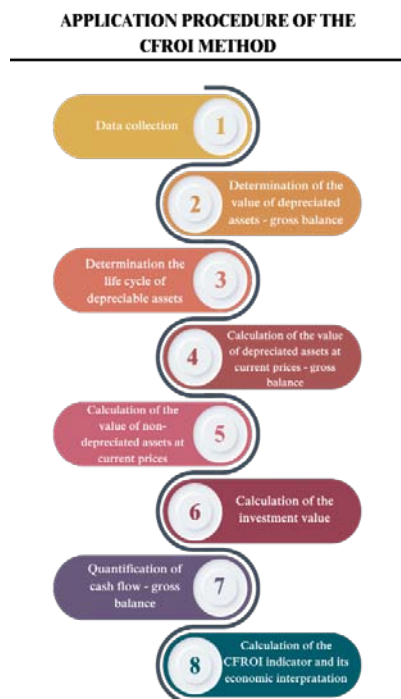
CF – gross cash flow from operating activities

CFROI compares the inflation-adjusted future taxable cash flow available to corporate investors. The recalculation is based on the assumption that the activity will not change over time and the cash flow will be constant throughout. At the same time, it is necessary to estimate the economic life of the enterprise's depreciable assets and also the value of assets that are not depreciated (Pavelková and Knápková, 2005).

4 Results and Discussion

The CFROI method can be defined as the operating performance that the enterprise would achieve if it could generate operating Cash Flow in the same volume during the lifetime of its operating assets but without additional investments. Operating return on investment helps evaluate the performance of an investment or enterprise. It can also be used as a calculation to help the stock market determine the prices based on Cash Flow. Two groups of data are needed to determine the level of operating return on investment, namely the value of the investment and cash flow. CFROI can be found in relative value or percentage terms, advantageous for comparison over time or to compare individual investments.

Figure 1: Application procedure of the CFROI method



Source: own processing

The practical application of the procedure for applying the CFROI method, as documented in Figure 1, includes eight consecutive steps. They are based on specific enterprise data, and their content and conclusions from an application are described. CFROI is one of the modern methods of evaluating business performance, and it is challenging to determine the initial data for calculating the CFROI indicator. The CFROI indicator depends on the availability of the necessary information.

1. The process of applying the CFROI method begins with data collection. These are data from the Financial statements, specifically its parts Balance Sheet, Profit and Loss Statement, Internal company records, Inventory cards and monitoring of the current price level of assets.

2. The value of depreciated assets is the sum of the purchase prices of the enterprise's long-term tangible and intangible assets. From this sum, it is subsequently necessary to deduct the value of the land and the value of the enterprise's unfinished long-term tangible and intangible assets. Acquisition prices are the prices at the time of acquisition of specific property components, including the costs associated with acquisition. They express the gross state of long-term tangible and long-term intangible assets.

Tab. 1: Value of depreciated assets of the enterprise – gross balance

Item	Unit of measure	2019	2020	2021	2022
Gross – intangible assets	€	29 787	29 787	28 478	28 478
Unfinished intangible assets	€	0	0	0	0
Gross – tangible assets	€	5 733 302	6 734 905	7 937 970	8 921 073
Land	€	701 930	701 930	701 930	701 930
Unfinished tangible assets	€	0	0	0	0
Gross depreciable assets	€	5 061 159	6 062 762	7 264 518	8 247 621

Source: Own processing according to the financial statements

3. The life span of the depreciated assets represents the average number of years for the enterprise during which they are

included in the property register. It is determined as a share of the enterprise's gross depreciable assets and the value of annual depreciation.

Tab. 2: The life span of the depreciated assets

Item	Unit of measure	2019	2020	2021	2022
Gross depreciated assets	€	5 061 159	6 062 762	7 264 518	8 247 621
Annual depreciation	€	313 931	320 062	391 547	584 404
Life span of assets	Period (year)	16	19	18	14

Source: Own processing according to internal records

According to Table 2, the lifetime of the enterprise's assets for individual years of the monitored period has a decreasing character. It is a consequence of increasing annual depreciation values. Their value has increased since 2019 by more than 200 thousand euros, while the gross value of depreciated assets has increased. This state may be due to the wear and tear of equipment in production during the constant operation necessary to satisfy customer requirements.

4. Calculating the value of depreciated assets at current prices is based on knowledge of the years of acquiring individual assets. In the starting year, a coefficient of 1.0 was applied. In subsequent periods, the price index based on consumer price index values was used. The current cost of depreciable assets can be determined by the product of the depreciable assets and the coefficient for each reporting period.

Tab. 3: Value of depreciated assets at current prices

Item	Unit of measure	2019	2020	2021	2022
Depreciated assets	€	5 061 159	6 062 762	7 264 518	8 247 621
Coefficient	Coef.	1	1,02	1,05	1,18
Depreciated assets in current prices	€	5 061 159	6 184 017	7 627 743	9 732 193

Source: datacube.statiscs.sk, own processing

The resulting values for individual monitored periods include the increase in the value of depreciated assets at current prices. This is due to the gradual increase in depreciated asset values and the price index for individual years of the monitored period.

5. The value of non-depreciated assets consists of monetary assets (long-term and short-term financial assets, receivables, deferred assets). The difference between monetary assets and non-interest-bearing liabilities can be used to obtain the value of net monetary assets. Subsequently, it is necessary to find out non-depreciated assets at current prices, which the enterprise will complete by adjusting net monetary assets for stocks at current prices and land forming part of long-term financial assets.

Tab. 4: Value of non-depreciated assets at current prices

Item	Unit of measure	2019	2020	2021	2022
Short-term financial assets	€	0	0	0	0
Long-term financial assets	€	0	0	0	0
Receivables	€	529 873	326 362	909 845	1 173 206
Accrual of assets	€	2 017	1 962	2 551	22 088
Monetary assets	€	531 890	328 324	912 396	1 195 294
Long-term non-interest-bearing liabilities	€	0	0	0	0
Reserves	€	37 483	37 764	52 795	71 583
Short-term non-interest-bearing liabilities	€	128 702	194 417	506 866	912 676
Accrued liabilities	€	1 520	0	0	139 800
Non-interest-bearing liabilities	€	167 705	232 181	559 661	1 124 059
Net monetary assets	€	364 185	96 143	352 708	71 235
Land	€	0	0	0	0
Inventories at current prices	€	1 612 187	1 609 422	2 417 330	3 089 892
Non-depreciated assets in current prices	€	1 976 372	1 705 565	2 770 038	3 161 127

Source: Own processing according to the financial statements

6. The value of the investment is determined by the sum of the values of depreciated assets at current prices and non-depreciated assets at current prices.

Tab. 5: Investment value

Item	Unit of measure	2019	2020	2021	2022
Non-depreciated assets in current prices	€	1 976 372	1 705 565	2 770 038	3 161 127
Depreciated assets in current prices	€	5 061 159	6 184 017	7 627 743	9 732 193
Investment value	€	7 037 531	7 889 582	10 397 781	12 893 320

Source: Own processing

The value of investments in individual years (Table 5) of the monitored period shows an increase. It is evidence of the efforts of the monitored enterprise to invest free funds.

7. Gross cash flow is based on the economic result from ordinary activities after taxation, adjusted for profit or loss from the sale of depreciated and non-depreciated assets, depreciation and interest costs.

Tab. 6: Cash flow of the enterprise

Item	Unit of measure	2019	2020	2021	2022
Profit after tax from operating income	€	-293 993	-35 575	71 531	272 562
Gross profit from the sale of material and fixed assets	€	365 454	88 635	197 561	67 106
Depreciation	€	313 931	320 062	391 547	584 404
Cost interest	€	153 012	161 000	190 132	226 554
Gross cash flow	€	538 404	534 122	850 771	1 150 626

Source: Own processing according to the financial statements

The operational return on investment indicator points to the enterprise's ability to evaluate its invested funds. For the sake of clarity, it can be displayed via a graph.

Figure 2: Development of the CFROI indicator



Source: Own processing

An economic interpretation of the resulting values of the CFROI indicator is necessary for managers to make decisions. It is implemented through:

1. comparison of development over time. A positive phenomenon is the positive value of the indicator throughout the monitored period. Between 2019 and 2020, there was a decrease in value, which is a negative phenomenon—years 2021 and 2022 increased value, which is a positive result. In order to increase the performance of the enterprise, managers are advised to increase the value throughout the period. It is necessary to take measures to maintain the indicator's growth trend.

2. comparison of the indicator with the average cost of capital WACC and that if
 $CFROI > WACC$ increases the value of the enterprise for shareholders.
 $CFROI < WACC$ there is a decrease in the value of the enterprise for shareholders.

Another comparison is possible through the net CFROI, which is referred to as the spread.

$$CFROI \text{ spread} = CFROI - WACC \quad (2)$$

CFROI - operational return on investment, financial performance of the enterprise

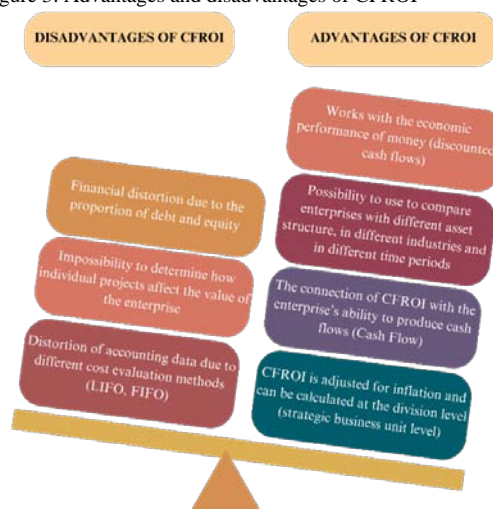
CFROI spread - net CFROI

WACC - average cost of capital

- CFROI spread can subsequently acquire a positive or negative value.
- $CFROI \text{ spread} > 0$ net operating return on investment is positive, and the enterprise creates new added value for shareholders.
- $CFROI \text{ spread} < 0$, the net operating return of the investment takes on negative values, and there is a depreciation of the shareholders' invested assets.

CFROI is mainly used by managers who can influence it with proper actions. CFROI represents the percentage rate of the return on the valuation model. The CFROI method has advantages and disadvantages, which are the content of Figure 3.

Figure 3: Advantages and disadvantages of CFROI



Source: Own processing

The advantage of the CFROI method is increasing the performance of processes thanks to a larger amount of relevant information with greater explanatory value. The enterprise can improve based on knowledge of the current situation in the business environment. Thanks to continuous improvement, the enterprise gains competitiveness in the market by using the essential information obtained from the performance value indicators.

The disadvantage of the CFROI method is that to calculate the CFROI indicator, on which the entire method is built, it is necessary to obtain a large amount of information and, simultaneously, to interest many people. It is necessary to prevent various types of errors from incorrect data, calculations and carelessness. For the correct introduction of the method and its subsequent use to define the performance value, it is necessary to determine the time, which is necessary to process the most accurate results. Processing the results of the indicators is a very demanding process, and a certain level of education is required, without which it is not possible to develop the resulting values of the indicators.

As stated in the paper, used methods in business conditions are complicated and demanding for data collection and processing. From the processed conclusions, it follows that the efforts of managers bring possibilities of use for evaluating the choice of investment, and performance of the enterprise, for determining the price on the stock market (the ratio of cash flow to the market value of invested capital), determining the return cash flow of the investment (the return must be higher than the cost of capital), an estimate of the total useful life of the enterprise's assets. It is intended to help managers and senior employees maintain a stable position of the enterprise in the market where it

operates, as well as ensure continuous development and growth, which impacts increasing competitiveness. From the scientific investigation of the CFROI method, it is possible to conclude and recommend to managers that the most suitable business activity is a high volume of sales with low controlled costs and low investment in assets.

5 Conclusion

The article presents the fulfilment of the goal, which was to identify the essential factors affecting CFROI with a subsequent analysis of the implementation process of this method. The consequence of the connection mentioned above is the systematic, holistically incorporated principles of the method into the decision-making of managers. The substantive content of the stages of applying the CFROI method was created, emphasising quantitative expression. The procedure for applying the CFROI method consists of eight parts, namely data collection, determination of the value of depreciated assets and their useful life, calculation of the value of depreciated assets at current prices, calculation of the value of non-depreciated assets, determination of the value of the investment, quantification of cash flow, calculation of the CFROI indicator and its economic interpretation. It points out the importance of conducting business performance evaluations through CFROI, which directly impacts business processes. The CFROI method is typically used annually, with an inflation-adjusted cost of capital adjustment. We concluded that through this comparison, it is possible to find out the rate of return on capital invested in assets through cash flow and the enterprise's operational performance achieved without additional investments during the life span of the assets. CFROI monitors not only the measure of economic performance (Cash Flow) but also the enterprise's value; the given measurement also affects managers' decisions. Based on it, it is possible to determine the percentage return of cash flows with respect to the market value of the capital that was used for investment. The contribution of the paper is the provision of new and unexpected views on the possibilities of using the CFROI method in the managers' decision-making process in investment-intensive enterprises, the proposal of practical steps to solve problems with investments, the opening of new directions for future research, the provision of space for polemics about the complexity of this process.

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Primary Paper Section: A

Secondary Paper Section: AH, AE

SELF-CONCEPT OF INDIVIDUALS WITH SPECIFIC LEARNING DISABILITIES: A RESEARCH OVERVIEW

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Abstract: This research overview examines the self-concept of individuals with specific learning disabilities (SLD), aiming to understand how these disabilities affect their self-perception, relationships, and overall life experiences. With a focus on age-related differences, the study uses the Self-concept Questionnaire (SCQ) to gather data from two age groups: adolescents (15-20 years) and adults (21-65 years). The findings reveal that self-concept among individuals with SLD is a dynamic construct influenced by various internal and external factors, including personal achievements, social interactions, and the challenges of their learning disabilities. The research identifies a notable prevalence of low self-esteem and anxiety and underscores the importance of empathy, support, and positive reinforcement in educational and professional environments.

Keywords: Self-Concept, specific learning disabilities.

1 Introduction

Self-concept is characterized as an individual's conception of himself or herself, which includes his or her evaluations, beliefs, and perceptions of his or her abilities, characteristics, and relationships with others (Harter, 2012; Hrabal, 2008). Thus, self-concept is the totality of the thoughts, feelings, and attitudes an individual has about himself or herself that influence his or her behavior and decision-making (Marsh & Craven, 2006; Macek, 2005). The development of self-concept occurs throughout the lifespan and is influenced by various factors such as social interactions, experiences, and culture (Leary & Tangney, 2012; Crookedhead, 2009).

Self-concept is a phenomenon that has been studied in psychology and social sciences for many years. It is defined as the cognitive component of the self-system, meaning it is a set of ideas and value judgments that describe the content of consciousness related to the self (Výrost & Slaměník, 2008; Orel et al., 2016). This construct is hypothetical because its existence and structure are derived from theoretical assumptions and empirical data (Výrost & Slaměník, 2008).

As stated by Dolejš, Dostál, Obereignerů, Orel, and Kňáček (2021), every person creates an image of himself and a relationship with himself from the beginning of his life. This image and relationship are influenced by several variables based on the individual's characteristics or are formed by interactions with his or her near and distant environment. The development of self-concept is influenced, on the one hand, by innate factors and, on the other hand, by acquired factors and their interaction. Self-concept is often negatively influenced by illness, poor interpersonal relationships, dysfunctional families, and, last but not least, disabilities or specific needs.

These specific needs may be specific learning disabilities. In the Czech Republic, the terminology regarding specific learning disabilities is not uniform. We encounter different labels, such as developmental learning disabilities, specific learning disabilities, or specific developmental disorders (Pokorná, 2010). Internationally, these disorders are known by different names, such as learning disability in the USA, dyslexia in France, specific learning difficulties in the UK, or legasthenia in Germany (Zelinková, 2015).

Specific learning disabilities are subdivided into specific types, including dyslexia, dysgraphia, dysorthographia, dyscalculia, dysmusia, dyspinxia, and dyspraxia (Pokorná, 2010). The prefix "dys-" denotes a discrepancy or deformity and, in the context of specific learning disabilities, is understood as a lack of or

incorrect development of skills. The following term refers to a specific deficit skill taken from Greek (Zelinková, 2015).

Specific learning disabilities include, for example, dyslexia, which is a disorder in the acquisition of reading skills and is the most well-known of them; dysgraphia, which impairs the graphic aspect of written expression; and dysorthographia, which manifests itself in specific dysorthographic phenomena and only secondarily affects the acquisition and application of grammatical rules; dyscalculia, also known as a disorder of acquisition of mathematical skills; dyspraxia, which is a disorder of acquisition, planning, and execution of free movements; dysmusia, which is a disorder of musical skills (Zelinková, 2015), but which is rare (Fischer, Škoda, 2008); and dyspinxia, a specific disorder of drawing (Michalová, 2001).

Within the school environment, we may also encounter pupils with a mixed learning disability, which is a combination of specific learning disabilities. Learners with specific learning disabilities often struggle with the effects of these disorders and may have negative attitudes towards certain subjects, teachers, learning, or school in general. They may also experience a range of psychosomatic difficulties, such as nausea or headaches, and some may have negative behavioral symptoms (Jucovičová, Záčková, 2017).

A student's self-concept is influenced by other people's evaluation of his/her personality. His successes and failures and comparisons with personal role models play a crucial role. Therefore, the overall support for this pupil is essential, which consists of three steps: adjusting the conditions of school work, re-education of specific learning disabilities, and providing help to strengthen the pupil and his parents to endure the long struggle with specific learning disabilities.

People with specific learning disabilities often excel in creativity, logical reasoning, or the ability to handle tasks of a constructive nature. However, negative self-image and self-concept may be caused by repeated school failures (Bartoňová, 2019). Bartoňová (2019) states that pupils with specific learning disabilities integrated into mainstream schools have a lower self-concept compared to pupils attending schools for these pupils. The approach of the environment and the specifics of the personality development of these pupils are closely related to the disorder and may affect self-concept. These pupils find it hard to tolerate punishment from parents and teachers but also crave support and encouragement to achieve a sense of security (Fischer, Skoda, 2008).

Family is crucial for support, help, and trust. Its influence is further reinforced by educational institutions and specific educators, whose impact can be positive or negative. The broader family structure, such as grandparents and relatives with personal experience of specific learning difficulties, also plays an indispensable role. Friends and coaches also play a significant role in the lives of these individuals.

Research by Brunswick and Bergary (2022) showed that students with dyslexia have lower levels of self-esteem. Gibby-Leversuch, Hartwell, and Wright (2021) examined the relationship between literacy problems, dyslexia, and self-concept in children and young people. They concluded that these people may be at greater risk of low self-concept.

In their research, Huang, Sun, Zhang, Lin, Lin, Wu, and Huang (2021) found that dyslexic children have poorer self-concept than their peers. They further highlight the need to improve self-concept in children with dyslexia for better physical and mental development. Burk and Hasbrouck (2023) present the consequences if people do not learn to read correctly, such as the increased risk of dropping out of school, anxiety, depression, and low self-concept.

Matějček, Vágnerová, et al. (2006) reported that students with low self-esteem regarding their reading skills have low overall self-concept and are dominated by negative emotions and low self-confidence. The best solution for people with these specific learning disabilities is to learn to cope with their disorders.

Family members of individuals with learning disabilities often face challenges related to their care. As Pokorná (2010) states, parental support is essential for these students from the first term of first grade onwards. For many parents, their children's performance is a surprise because it has not met their expectations. They are also often disappointed by their child's poor performance despite having practiced with them regularly. Such situations can lead to feelings of helplessness, stress, dissatisfaction, and guilt, which both teachers and parents of children often overlook. Educators need to be aware of these challenging circumstances.

Research by Sahu and colleagues (2018) has shown that the school problems of students with learning disabilities significantly affect the lives of their parents, who often have to give up some of their leisure activities in order to give their children sufficient attention to their studies.

The family is the basic social unit that should support and assist all its members. It should convey important information to children, motivate them to learn, be role models, provide them with a sense of safety and security, and help them develop adaptive skills (Paulík, 2017).

Parental disappointment can be a traumatic experience for a first-grade student (Pokorná, 2010). Matějček, Vágnerová et al. (2006) reported low levels of empathy among parents of students with learning disabilities, which may be due to their excessive focus on the child's school performance. A study by these authors also showed that the self-esteem of pupils with learning disabilities deteriorates with age, and they begin to rate their abilities as below average. They often feel that their parents are too directive and strict, which may result from a lack of emotional expression and support. A positive parent-child relationship can contribute significantly to a child's self-esteem and self-confidence, whereas a negative emotional relationship and a directive parenting style can do the opposite.

School can also impact students' self-esteem and self-worth, as their school performance is reflected in their self-concept (Vágnerová, 2012). School can be a compensatory factor for pupils whose families are failing (Jackson, Martin, 1998 in Paulík, 2017). Teachers, classmates, and family are also important sources of support for pupils (Rai, Stanton, Wu et al., 2003 in Paulík, 2017).

Richman, Rosenfeld, and Bowen (1998 in Paulík, 2017) argue that social support can influence school performance. Students with different types of social support available tend to have higher school achievement than those who do not have this support.

According to Krivohlavý (2009), social support is the help others provide to individuals in a challenging situation. Teachers should fulfill different student roles - friend, protector, and mentor (Davis, 2001). Classmates can be natural sources of resilience against stress (Paulík, 2017) and fulfill needs such as feeling safe, learning, and self-validation (Vágnerová, 2012). Friendships include confiding, listening, and mutual support (Mares, 2001).

Unfortunately, individuals with dyslexia and other specific learning disabilities are often confronted with misconceptions and myths, such as claims that they are lazy or that they should not study. Some non-experts even incorrectly associate these disorders with a lack of intelligence.

It is also often, unfortunately, true that individuals with these disorders are not sufficiently informed about their condition. Some parents fear exposing their children to potential social exclusion and prefer to avoid having their children examined.

Sometimes, they even fear "labeling" their child incompetent (Zelinková, Čedík, 2013).

On the other hand, the examination can bring many benefits, such as clarifying the individual's difficulties and finding ways to alleviate and compensate for these difficulties (Zelinková, Čedík, 2013). In order to best tailor support measures for the pupil or student, a good diagnosis of specific learning disabilities is essential and can help to ensure successful learning (Bartoňová, 2019).

According to Bartoňová (2019), the basis of diagnosis is to identify the pupil's needs, not to "label" them. Diagnosis and intervention should be carried out in conjunction with each other and concerning barriers to learning. The class teacher's role in the diagnostic process should comprehensively include the pupil's social relationships, interests, and values.

The examination of specific learning disabilities is carried out by the educational-psychological counseling center, which also makes the final diagnosis. The counseling center also provides pupils with specific learning difficulties with support measures, usually from level 1 to level 3. The first level, which is designed to compensate for mild learning difficulties, is determined by the school. The same school draws up an educational support plan.

Second- and third-level support measures are determined by the pedagogical-psychological counseling center on the basis of a recommendation from the school counseling center and with the informed consent of the adult pupil or his or her legal representative. Pupils in the second and third levels require an individual approach, may use particular textbooks and aids, and are provided special educational care.

University students can use the university's specialist departments, student support centers, or the educational and psychological counseling center. They can also be provided with support during the admission procedure and their studies, for example, increasing the time limit, creating optimal study conditions, or the possibility of making an audio recording of the lessons (Zelinková, Čedík, 2013).

In the work process, an individual with dyslexia may face hopelessness due to feeling overwhelmed by different materials and written texts. It is essential that he or she can openly communicate how he or she feels and what difficulties to expect. Fortunately, some employers are aware of specific learning disabilities and try to help their employees, for example, by tolerating their slow pace, showing patience, and simplifying, and repeating instructions (Zelinková, Čedík, 2013).

Adults with specific learning disabilities can benefit from joining community groups led by a professional. These groups offer them a space to share their life experiences and the particular challenges they face. Participation in these communities brings relief, support, and understanding and helps them find solutions and new perspectives. The inherent value of these community groups is a sense of security and belonging.

In addition, they can use self-help community groups where they meet people with the same or similar difficulties and experiences. This environment provides them valuable support and understanding (Zelinková, Čedík, 2013).

2 Literature review

Before using the research instrument, a literature review was conducted to find studies investigating the relationship between the constructs of dyslexia, dysgraphia, dysorthography, and the self-concept questionnaire.

In this search, we tried to find studies that could help us answer the question: "What is the self-concept of people with specific learning disabilities?"

We used the keywords specific learning disabilities, dyslexia, dysgraphia, dysorthography, self-concept, and self-concept

questionnaire to search for relevant resources. We searched the MEDLINE Complete, Complementary Index, Academic Search Ultimate, and CINAHL Ultimate databases.

Review question: What is the self-concept of people with specific learning disabilities?

Inclusion criteria:

Persons with specific learning disabilities must be classified in Standard 1 or Standard 2 (Standard 1: 15-20 years, Standard 2: 21-65 years)

Exclusive criteria:

- People without specific learning disabilities.
- Persons under 15 years of age and persons over 65 years of age.

Information sources/databases:

- MEDLINE Complete
- Complementary Index
- Academic Search Ultimate
- CINAHL Ultimate

Data refinement:

- English language
- full text
- Reviewed by

Bounded period:

- 2019-2023

Topic:

- special education (special pedagogy)

Content sources:

- MEDLINE Complete
- Complementary Index
- Academic Search Ultimate
- CINAHL Ultimate

A selection of studies: We removed duplicates from the studies we found.

Search strategies in English: "specific learning disabilities" AND (dyslexia OR dysgraphia OR dysortographia); "self-concept"; "self-concept questionnaire"; "specific learning disabilities" AND (dyslexia OR dysgraphia OR dysortographia) AND "self-concept"; "specific learning disabilities" AND (dyslexia OR dysgraphia OR dysortographia) AND "self-concept; questionnaire"

Tab. 1: Search results according to the selected criteria.

	Population	Intervention	Intervention	Results 1	Results 2
Limitations - abstract	(dyslexia OR dysgraphia OR dysortographia)	"self-concept"	"self-concept questionnaire"	(dyslexia OR dysgraphia OR dysortographia) AND "self-concept"	(dyslexia OR dysgraphia OR dysortographia) AND "self-concept questionnaire"
MEDLINE Complete	967	1122	28	3	0
Complementary Index	1162	1869	42	2	0
Academic Search Ultimate	1035	1578	25	2	0
CINAHL Ultimate	371	607	18	1	0
Directory of Open Access	574	1036	56	4	0

Journals					
APA PsycInfo	788	1422	13	3	0
MEDLINE	968	1117	27	3	0
OpenAIRE	284	518	20	1	0

As a result of the conducted research, it was found that no study in the internationally published literature investigates the relationship between the concept of dyslexia, dysgraphia, dysorthography, and the self-concept questionnaire.

Tab. 2: Summary of studies on the self-concept of people with specific learning disabilities.

Author Year Title Number of participants (if specified)	Key related results
<ul style="list-style-type: none"> • Brunswick, Nicola • Bargary, Serena • 2022 • Self-concept, creativity and developmental dyslexia in university students: Effects of age of assessment. • 145 University students with dyslexia 	The survey assessed self-esteem, self-efficacy, creativity, and estimated intelligence. Students with dyslexia reported lower levels of self-esteem, self-worth, and estimated intelligence. When the age of assessment was considered, those who were assessed early showed lower self-esteem and self-efficacy but no difference in estimated intelligence. Those assessed late showed lower estimated intelligence and self-esteem but no difference in self-efficacy. The findings highlight the importance of providing psychological support to dyslexic students to improve their self-concept.
<ul style="list-style-type: none"> • Lindeblad, Emma • Nilsson, Staffan • Gustafson, Stefan • Svensson, Idor • Costa, Sebastiano • 2019 • Self-concepts and psychological health in children and adolescents with reading difficulties and the impact of assistive technology to compensate and facilitate reading ability. • 137 children and adolescents with reading difficulties 	This study examined self-image, mental health, and the effects of assistive technology (AT) on self-concept and mental health in 137 children and adolescents with reading difficulties during a systematic intervention program and at a one-year follow-up. Participants were randomly assigned to a control or intervention group—the interventions aimed to teach participants how to comprehend texts using AT. The control group received no intervention. To examine self-esteem, self-worth, anxiety, and depression, all participants were assessed using the Cultural Self-Esteem Inventory, 3rd edition (CFSEI-3) before the intervention and one year after the interventions. Forty-one participants were also assessed on the Beck Youth Inventory (BYI). The AT was found not to affect participants' self-esteem. The CFSEI-3 showed similar levels of self-esteem in the norm and study groups at the pre-intervention time point, resulting in less of the expected increase due to the use of AT. The results are discussed regarding contextual explanatory factors such as teachers' increased knowledge of reading difficulties and dyslexia. The results of the BYI were somewhat inconclusive because the younger group of participants showed more anxiety than the norm group, but the adolescent group did not. This may be due to the small sample size, so further research is recommended.
<ul style="list-style-type: none"> • Rosa Gibby-Leversuch, Brittany K. Hartwell & Sarah Wright • 2021 • Dyslexia, Literacy Difficulties and the Self-Perceptions of Children and Young People: A Systematic Review 	This systematic review explores the links between literacy difficulties, dyslexia, and children and young people's (CYP) self-concept. It builds on and updates Burden's (2008) review and explores how other factors of attribution style and dyslexia labeling may contribute to CYP's self-concept. Nineteen articles are included and assessed for quality. Quantitative papers measured self-perceptions of CYP with literacy difficulties and/or dyslexia (LitD/D) and compared them with CYP without LitD/D. Qualitative papers explored the lived experiences of CYP with LitD/D, including their self-perceptions and how they were affected by receiving a diagnosis of dyslexia. Results suggest that CYP with LitD/D may be at greater risk of developing negative self-perceptions as learners but not their overall self-esteem. Factors relevant to promoting positive self-perceptions include adaptive attributional styles, good relationships with peers and parents, and positive attitudes toward dyslexia and neurodiversity. In some cases, CYPs with LitD/D felt that others perceived them as unintelligent or inactive; for these CYPs, the diagnosis led to a more positive self-perception because it provided an alternative image of themselves. Further research is needed to explore the impact of attributional style and the potential for intervention, as well as CYP experiences of diagnosis and associated advantages or disadvantages.
<ul style="list-style-type: none"> • Anyan Huang, Mingfan Sun, Xuanzhi Zhang, Yuhang Lin, Xuecong Lin, Kusheng Wu, Yanhong Huang • 2021 	They used the Piers-Harris Children's Self-Concept Scale (PHCSS) and the Chinese version of the Egna Minnen Beträffande Uppfostran for Children (EMBU-C) to assess the self-concept and parenting styles of the study population. The results showed that academic competence,

<ul style="list-style-type: none"> Self-Concept in Primary School Student with Dyslexia: The Relationship to Parental Rearing Styles 50 dyslexic children and 50 intact children 	<p>popularity, and general self-concept in the dyslexic group were significantly lower than those in the control group ($p < 0.05$). Based on multivariate linear regression, they also found that residence ($\beta = -0.32, p < 0.05$) and physical activity ($\beta = 0.36, p < 0.01$) could influence the self-concept factors of dyslexic children. In addition, Spearman's correlation analysis found a moderate and positive correlation between self-concept of physical appearance and maternal emotional warmth ($r = 0.36, p < 0.05$). The results suggest that dyslexic children have poorer self-concept than typically developing children. The self-concept of dyslexic children should be improved to achieve better physical and mental development.</p>
<ul style="list-style-type: none"> Solgi Z., Veisi R. 2019 The effectiveness of Mindfulness Training on anxiety sensitivity, self-concept and academic self-efficacy of students with dysgraphia 114 persons with dysgraphia 	<p>Findings showed that mindfulness training had a significant effect on anxiety sensitivity ($F = 16.46, P = 0.001$), self-concept ($F = 51.97, P = 0.001$), and educational self-efficacy ($F = 69.69, P = 0.001$), and this effect remained unchanged at the 2-month follow-up. Conclusion: Since mindfulness training leads to acceptance of emotions and physical and psychological symptoms in students, it can be used as an effective intervention method to reduce psychological problems, especially in children with dysgraphia.</p>
<ul style="list-style-type: none"> Burk K., Hasbrouck J. 2023 Connecting the science of reading to social justice: Introduction to the special section. 	<p>The Science of Reading is a consensus of research conducted across many disciplines over many years that informs how children learn to read, the types of instructional practices that work best for most students, and how to address the needs of students who struggle with reading. This converging body of evidence strongly suggests that approximately 95% of children can be taught to read at or near grade level, including students with dyslexia or other learning disabilities (Moats, 2020). Despite this compelling evidence, two-thirds of children in this country cannot read proficiently, and these data illustrate persistent disparities in reading proficiency across race, English learners, disability, and socioeconomic status (National Center for Education Statistics, 2022). The consequences of not learning to read correctly are profound, including increased risk of dropping out of school, anxiety, depression, and low self-concept.</p>

3 Research on the self-concept of people with specific learning disabilities

The research aims to determine the level of self-concept in people with specific learning disabilities. The research instrument used was the "Self-concept Questionnaire (SCQ)" by Dolejš, Dostál, Obereignerů, Orel and Kňážek (2021). The Self-concept Questionnaire (SCQ) provides information from several subdomains of a person that significantly influence and shape self-concept.

The questionnaire measures self-concept in adolescents (15-20 years) and adults (21-65 years). The presented questionnaire meets the methodological requirements imposed on this diagnostic instrument, and the method was developed on a sufficient theoretical basis. The self-concept questionnaire has 36 items in its basic form but also an 18-item version. We chose the full version of 36 statements.

The questionnaire reflects a variety of life themes that contribute to the formation of self-concept (coexistence within the family, functioning in professional or academic life, physical self-concept, balanced experience, acceptance by the social environment outside the family, happiness, and satisfaction, and perceived transcendence and meaningfulness of existence). The method includes six subscales: Social adaptability; Work and studies; Body confidence; Resistance to anxiety; Popularity in the society; Sense of meaning and self-actualization (see Table 3). The evaluation of the method includes a total score, which, according to the authors, is the most reliable indicator (Dolejš, Dostál, Obereignerů, Orel and Kňážek, 2021).

Proband answers the following statements on a four-point scale: strongly disagree/disagree/agree/strongly agree. At the same time, the authors of the questionnaire provide guidelines for decision-making on the above scale in the instructions to the questionnaire. "Strongly disagree - 90 percent or more disagree with the statement; disagree - the statement does not apply to the

proband only occasionally; agree - the statement applies to the proband only occasionally; strongly agree - 90 percent or more agree with the statement." (pp. 46)

Tab. 3: QSC-36 Inventory Scales and Items (Items marked with an asterisk are reverse scored).

Inventory Scales	Questionnaire Items
Social adaptability	1 Others at home are bothered by the way I behave.*
	7 I have no trouble getting along with people.
	13 I often get into troubles.*
	19 I often have a problem accepting the opinions of the others.*
	25 I often last only a short while in relationships.*
Work and studies	31 I often get into conflicts with others.*
	2 I am successful at work/school.
	8 I manage to fulfill my work/school duties.
	14 I am a good employee/student.
	20 I have an important role in the working team.
Body confidence	26 I am slow at work.*
	32 I feel sure at work/school.
	3 It bothers me how I look.*
	9 I look physically good.
	15 I would like to have a different body.*
Resistance to anxiety	21 I am in good physical shape.
	27 I have quite a pretty face.
	33 I often tell myself I should do something with my body.*
	4 I am often worried.*
	10 I get nervous.*
Popularity in the society	16 I am often worried, but I do not know why.*
	22 I am often sad.*
	28 I am a well-balanced person.
	34 I often feel anxious.*
	5 I feel excluded by the collective.*
Sense of meaning and self-actualization	11 I am rather unpopular.*
	17 I am usually the last one that is invited.*
	23 I have a lot of friends.
	29 People respect me.
	35 It is difficult for me to find friends.*
	6 I know where my life should go.
	12 Once there will be something left after me.
	18 I see the meaning in my life.
	24 I have a good opportunity of self-realization.
	30 My future is positive.
	36 I manage to find meaning.

A total of 88 people with specific learning disabilities participated in the study: 33 aged 15-20 and 55 aged 21-54.

The group was categorized by age into 15-20 and 21-65 years and evaluated according to the respective age norms.

The following table shows the population of people with specific learning disabilities aged 15-20 years. The scores on each subscale of the self-assessment questionnaire and the total score are shown for each individual.

Tab. 4: Population of respondents aged 15-20 years and their scores in each area.

Number	Social adaptability	Work and studies	Body confidence	Resistance to anxiety	Popularity in the society	Sense of meaning and self-actualization	Total score
1.	54	40	59	57	58	45	54
2.	54	51	65	54	58	51	59
3.	46	48	53	60	46	48	50
4.	46	48	51	49	52	45	47
5.	50	59	56	54	55	40	53
6.	24	33	43	44	38	42	34
7.	50	51	59	60	46	60	57
8.	70	63	53	77	74	63	74
9.	50	40	51	46	46	48	45
10.	46	37	43	49	40	42	40
11.	32	23	51	46	38	48	37
12.	35	44	53	49	40	40	41
13.	50	48	43	44	30	54	41
14.	39	23	51	31	38	37	32
15.	32	51	35	49	61	48	44
16.	46	51	45	46	52	45	46
17.	50	51	48	46	52	48	48
18.	46	37	53	49	43	48	45
19.	66	40	59	38	43	51	48
20.	50	33	48	49	40	45	42
21.	58	55	59	74	58	63	67
22.	54	48	53	65	49	48	54

23.	54	48	53	54	46	51	51
24.	50	48	59	54	49	60	55
25.	54	40	35	35	32	40	34
26.	46	40	59	52	46	57	50
27.	66	48	65	54	58	54	61
28.	39	33	59	63	49	51	50
29.	66	55	77	74	49	48	67
30.	54	40	62	57	32	51	49
31.	58	48	45	31	38	48	41
32.	54	44	59	63	58	51	58
33.	32	37	62	44	38	54	43

The SCQ authors consider the total questionnaire score the most psychometrically reliable indicator. Of 33 individuals aged 15-20 years, four show low total scores and severe doubts about their own worth. "Negative evaluations cut across multiple domains and are reflected in the individual's social functioning, with elements of withdrawal, discomfort with one's status, negativism, pessimistic self-concept, and passivity to inactivity in social relationships (maintained by fewer individuals) present. Furthermore, these individuals feel that their relationships are bad and blame themselves. The feeling of bad relationships is often part of family life. In extreme cases, low self-concept manifests in feelings of unpopularity, rejection by others, and social isolation. Individuals with low self-concepts fear acceptance by the social environment; they suffer from fear of their real, but more often only perceived shortcomings. Negative self-concept is largely based on the individual's internal subjective evaluations. Reduced self-concept is part of the clinicopathological picture, for example, in individuals with mood disorders based on anxiety or depressive symptoms." (pp. 53)

The exact number of respondents (4) showed above-average overall scores. Thus, these individuals rated themselves very positively. "They have no doubts about their abilities, are confident, active, and often less dependent on evaluation by others or those around them. The self-confidence resulting from a stable self-concept also carries over into social relationships, which are rated by these individuals as high quality, with appropriate depth, and fully satisfying. Within the psychopathological picture, extremely elevated self-concept is manifested in uncritical individuals, with features of grandiosity and ego grandiosity, or in individuals who do not admit to the slightest defects, failures, or moderate self-assessment. (pp. 53)" Thus, the majority of individuals (25) with specific learning disabilities were in the average score range, which indicates well-integrated individuals with a reasonable self-image. The self-concept is balanced, with a good view of both positive and negative elements in different areas of self-concept.

Tab. 5: Population of respondents aged 21-65 and their scores in each area.

Number	Social adaptability	Work and studies	Body confidence	Resistance to anxiety	Popularity in the society	Sense of meaning and self-actualization	Total score
1.	68	40	54	46	63	58	58
2.	55	54	70	69	67	69	69
3.	50	54	62	37	56	47	50
4.	50	58	58	53	56	62	60
5.	20	36	33	40	44	47	32
6.	28	49	33	31	44	36	32
7.	28	49	33	31	44	36	32
8.	24	49	51	37	52	39	38
9.	59	66	47	46	36	72	57
10.	28	20	20	21	20	20	20
11.	46	32	47	28	20	43	29
12.	20	28	22	21	22	23	20
13.	37	45	36	25	29	43	30
14.	59	45	66	46	63	50	58
15.	55	45	54	49	56	50	53
16.	24	36	40	21	26	36	23
17.	32	49	54	49	56	69	54
18.	59	40	54	63	67	58	62
19.	37	32	40	28	36	26	27
20.	41	40	40	25	44	36	32
21.	50	49	43	43	44	47	43
22.	68	54	66	40	63	47	59
23.	46	40	51	34	20	62	37
24.	50	36	62	43	48	47	46

25.	41	45	66	56	71	58	61
26.	59	49	51	37	60	47	49
27.	46	24	36	25	33	39	28
28.	37	40	43	28	40	36	32
29.	50	45	33	43	26	39	34
30.	55	36	51	37	48	50	43
31.	55	58	47	69	33	62	57
32.	50	45	51	34	44	47	41
33.	41	40	51	46	52	39	42
34.	46	24	36	28	52	23	29
35.	46	36	62	43	48	39	43
36.	20	36	62	31	29	29	29
37.	46	24	58	31	52	43	38
38.	72	36	54	56	40	39	49
39.	41	36	51	49	48	50	44
40.	24	40	43	25	33	33	27
41.	72	74	43	56	56	72	66
42.	32	24	22	40	44	36	28
43.	59	36	66	34	29	50	42
44.	64	20	80	37	75	50	56
45.	28	36	54	34	56	43	38
46.	50	62	66	49	60	69	64
47.	50	49	58	53	33	50	48
48.	50	20	43	25	36	20	25
49.	37	28	51	40	36	50	36
50.	37	36	26	37	48	36	32
51.	46	36	36	25	63	47	37
52.	41	58	51	21	56	50	42
53.	41	45	54	43	44	33	39
54.	64	36	62	21	33	43	38
55.	55	40	40	34	26	26	31

From Table 5, out of the sample of 55 respondents aged 21-65, 28 respondents are in the low score band, six are in the above-average score band, and 21 are in the average score band.

In both age categories, there are individuals with different levels of self-concept, from low to average to above average. The younger group had a more balanced distribution between low and above-average scores, while the older group had a higher proportion of individuals with low self-concept. In both groups, most participants were rated as well-integrated with average self-concept.

4 Discussion

A total of 88 people with specific learning disabilities aged 20-54 participated in the study, of whom 33 were aged 15-20, and 55 were aged 21-54.

The research, which focused on individuals' self-assessment in different areas of their lives, revealed exciting results, divided into two main age categories: younger respondents aged 15-20 and adult respondents aged 21-65. This data was carefully collected and analyzed better to understand certain social and personal well-being aspects.

The results of low scores in both age groups across all scales have been tabulated in the following table.

Tab. 6: Low scores in both age groups across all scales.

	Social adaptability	Work and studies	Body confidence	Resistance to anxiety	Popularity in the society	Sense of meaning and self-actualization	Total score
Respondents (15-20y)	7 (21.2%)	8 (24.2%)	1 (3.0%)	4 (12.1%)	0 (0%)	1 (3.0%)	4 (12.1%)
Respondents (21-65y)	17 (30.9%)	24 (43.6%)	13 (23.6%)	29 (52.7%)	19 (34.5%)	22 (40%)	28 (50.9%)

In the younger group of respondents, i.e., aged 15-20 years, it can be seen that only seven persons, representing 21.21% of this group, think that they have low social adjustment skills. This indicator may be significant as social interaction and the ability to adapt to different social situations are essential for psychological well-being and success in personal life. Another segment that requires attention is the area of work and study. Almost a quarter of the young respondents, more precisely eight individuals (24.24%), think they need to achieve satisfactory

results. This low score may indicate potential problems with academic performance or finding and keeping a job. These factors may significantly affect these young people's future opportunities and life trajectories. Looking at physical appearance, we find that only one respondent (3.03%) in this age group feels that their physical appearance is insufficient. This low number suggests that most young people are satisfied with their appearance or consider it a minor problem. Anxiety resilience is another critical area in which four respondents (12.12%) report low scores. This may indicate that this group tends to be more subject to anxiety-building or stressful situations, which may hurt their overall mental well-being. In terms of popularity in the collective, there were no respondents with low scores, which is a positive signal indicating that young people in this age group feel accepted by their peers. Meaning and self-actualization, critical components for feeling fulfilled in life, are areas where only one respondent scores low.

We now move on to the second age category, focusing on adult respondents aged 21-65. In this group, 17 individuals (30.91%) rate their social adaptability as insufficient. This result may be worrying as it shows that many adults have difficulty adapting to their social environment, which may limit their ability to successfully communicate and establish relationships in their personal and professional lives. Even 24 respondents (43.64%) report failing to achieve satisfactory results in the sphere of work and study. This figure is alarming as it shows that almost half of the adult respondents with specific learning disabilities have difficulties in achieving goals or maintaining productivity at work or in further education. Physical appearance is an area where 13 respondents (23.64%) score low. This high percentage may reflect societal pressure on appearance and affect an individual's self-esteem and overall satisfaction. In the area of anxiety resilience, 29 respondents (52.73%) show low scores, which is concerning as this may indicate high levels of stress and anxiety in this age group. This is particularly important in today's hectic times when people face many pressures and challenges. Popularity within the team is an area where 19 respondents (34.55%) feel they are not liked enough by their colleagues. This may affect their ability to form and maintain relationships at work or in other group contexts. Finally, meaning and self-fulfillment are vital to a sense of life fulfillment, and this is an area where 22 respondents (40%) feel a lack. This can lead to feelings of failure and frustration when individuals cannot achieve their personal goals or find meaningful work. These results show that low scores across the various self-assessment scales in both age groups may indicate more profound issues that should be the subject of further investigation and intervention.

We now focus on the subscales with the highest percentage of low scores in both age groups.

Specifically, a low score in the "work and study" subscale (8 individuals - 24.24% in the 15-20 age group) may indicate that the individual faces work or study environment challenges. This can result from many factors, from personal obstacles such as stress or lack of motivation to external factors such as unfavorable working conditions or lack of academic support. These individuals may feel that their performance could be better than their peers, leading to frustration and failure. Low scores in this area may only sometimes be a persistent characteristic. For younger adults, it may be a transient phenomenon that reflects a short-term developmental period or a period of adjustment to new life roles and responsibilities. Young people often undergo changes and challenges, such as entering university or their first work experience, which may be associated with uncertainty and searching. For older adults, on the other hand, low scores may be perceived as a more stable or even chronic aspect of their self-image. At this stage of life, individuals may have a long history of work experience that may influence their self-assessment. If they have experienced long-term difficulties or setbacks, this may lead to dissatisfaction and a negative perception of their abilities. It is important to note that the subscale of work and study is strongly influenced by age. This means an individual's age can be a significant factor in interpreting results. Older

adults typically have a broader range of work experiences that may influence their perceptions of success and self-esteem. In contrast, younger adults are often early in their career or educational paths, which may lead to more significant variability in their self-assessment in these areas.

The situation is more pronounced in the group of older respondents (21-65 years old) - low scores in the areas of anxiety resilience (52.73%) and work and study (43.64%) are most pronounced. These results suggest that anxiety and problems at work or study are very significant in this group and can hurt overall well-being and quality of life.

Our research on psychological resilience and general well-being focused on different age groups. One of these groups included respondents aged between 21 and 65, representing a demographic with a wide range of life stages and experiences. The results showed that this group, in particular, showed markedly different and distinct trends compared to other age groups. Specifically, more than half of the respondents in this category, 52.73%, were found to score low on a domain that measures resilience to anxiety. This result is alarming as it indicates a high prevalence of anxiety symptoms among adults and middle-aged persons. Significantly low anxiety resilience can have wide-ranging effects on an individual's daily functioning, including their ability to manage stress and cope with life's challenges. Another area where a significant percentage of low scores were recorded was related to work and study, where 43.64% of respondents reported low scores. This finding suggests that problems related to work or studies are a significant source of stress for this age group. Since many people in this age group are either in the middle of their careers or trying to achieve academic goals, these problems can significantly affect their professional and personal lives. These results suggest that anxiety and problems at work or study are very significant in this group and can hurt individuals' overall well-being and quality of life. It is important to note that these problems do not only have immediate consequences but can also contribute to longer-term health complications, including psychological and somatic illnesses. Thus, the survey results can serve as a basis for designing targeted intervention programs and support services for this demographic group to improve their psychological resilience and quality of work and personal life.

Detailed analysis of the data from the social adjustment, liking in the group, and meaning and self-actualization subscales revealed that a significant proportion of respondents scored low in these areas. This finding may be of concern as it suggests that these individuals may have difficulty adapting to their social environment, are unsure of their place within the group, or struggle to find meaning and satisfaction in their personal and professional goals. Low scores on social adjustment could indicate that individuals have difficulty forming new relationships or adapting to changes in existing social groups. Regarding likeability in a group, low scores may reflect feelings of isolation or lack of recognition by other group members. In terms of meaning and self-actualization, low scores may reveal more profound problems with identifying one's values and goals, leading to feelings of loss of direction and lack of motivation in life.

5 Conclusion

Research in the interdisciplinary collaboration between psychology and special education is one major topic that requires our attention. This is the self-concept of individuals facing specific learning disabilities. This area is highly diverse and full of nuances, reflected in the various results that have emerged from the research. Their complexity is due to many factors that shape and influence self-concept. In particular, age emerges as a significant determinant. It is remarkable how self-concept develops and changes as an individual ages. As for specific learning disabilities, these are not uniform. These special needs manifest themselves differently and specifically impact an individual's self-concept. For example, dyslexia, which affects reading and writing skills, may have a different impact on self-concept than dyscalculia, which relates to

difficulties with mathematics. Each type of learning disability brings a unique set of challenges that the individual must deal with.

Social interactions are another critical factor that plays a role in the development of self-concept. Friendships, relationships with family, teachers, and peers - all of these social connections can either strengthen an individual's self-esteem or contribute to its weakening. How individuals with specific learning disabilities are accepted and supported in their social environment can significantly impact how they see and evaluate themselves. At the same time, personal experiences are inextricably linked to self-concept formation. Every success, failure, setback, and victory contributes to an individual's image of himself or herself. For individuals with specific learning disabilities, these experiences may include struggles with academic tasks that, for others, may represent routine activities. In the areas of work and study, research reveals that individuals with specific learning disabilities often encounter significant barriers. These difficulties are not confined to the academic environment but spill over into the professional sphere, negatively impacting their career development and professional satisfaction. As work and study are essential components of self-concept, these challenges can lead to low self-esteem and self-worth.

Interestingly, the research noted a high prevalence of low scores on anxiety resilience among older respondents. This trend may be interpreted as an indicator that the risk of psychological difficulties may increase with age. This phenomenon could result from accumulated negative experiences and frustrations associated with prolonged exposure to a maladaptive educational system or work environment. Overall, research suggests that the self-concept of people with specific learning disabilities is not a static or isolated variable. It is a dynamic and multifactorial construct influenced by various individual and external factors. Understanding these influences is critical to developing effective interventions and support strategies to help these individuals academically and professionally.

The research findings provide insightful insights into the complex situation experienced by individuals with specific learning disabilities. The issue is wide-ranging and complex, touching on many aspects of these individuals' lives. The research points to the fact that self-concept is a significant issue that requires increased attention and intervention from professionals in many fields. It is also clear that society should not ignore this issue. Self-concept is a crucial element that influences an individual's personal, academic, and professional life. It is, therefore, essential that specific learning disabilities are seen not only as an educational barrier but also with an emphasis on their impact on the self-perception and self-esteem of those who suffer from them. Research highlights the need for a holistic approach considering all factors affecting self-concept. Individuals with these disorders must be supported in their educational and professional development. One of the most significant issues that has a direct impact on self-concept is anxiety. Anxiety can arise as a reaction to setbacks or fear of future challenges that may be associated with their disorder. Therefore, preventing and working with anxiety is considered a critical component of interventions aimed at improving the self-concept of people with learning disabilities. The family environment, school system, and workplace should be designed to promote the development of self-esteem and self-efficacy in these individuals. It is essential that these people feel valuable, capable, and respected in their communities and work teams. An approach based on empathy, understanding, and positive reinforcement can lead to an environment where individuals with specific learning disabilities can feel safe and motivated to achieve their goals. In conclusion, the research highlights the multifaceted impact of specific learning disabilities on individuals' self-concept and the need for a comprehensive approach to addressing this issue. It is imperative that this issue becomes a matter of public concern and that effective strategies and measures from all relevant sectors of society are applied to it.

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Primary Paper Section: A

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THE IMPACT OF DEVELOPMENT-HOUSING PROJECTS ON DIFFERENT AREAS OF PERFORMANCE

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Abstract: This paper focuses on a systematic assessment of the impact of development projects on different performance areas, with an emphasis on social. In the context of the ever-evolving digital era, development projects are becoming a key element for achieving competitiveness and sustainability in all sectors. The aim of this paper is to analyze how development (housing) projects affect economic growth, firm efficiency, social interaction and sustainable development from a theoretical knowledge perspective.

Keywords: housing development, performance, economic area, social area

1 Introduction

In general, the term "development" can be considered as a process that creates growth, progress, positive change or addition to physical, economic, environmental, social and demographic components. The goal is to increase the standard and quality of life of the population and to create or expand local regional income and employment opportunities without harming environmental resources (Society for International Development, 2021).

Performance is a measure of the success, efficiency or quality of the execution of an activity, task or system relative to stated objectives, standards or expectations. Performance evaluation can be characterized as a process of developing indicators that aim to assessing progress towards predetermined objectives and comparing actual performance against these indicators. In general, any performance needs to be monitored and evaluated in some way as part of a feedback loop, which makes it worthwhile to address this area in the enterprise (Huyett and Viguerie, 2005). Performance indicators are of a different nature and should reflect the extent to which available resources are used to achieve the desired results (Bumbescu, 2020).

Performance measurement in the construction industry has been carried out over the years using different approaches. These are: Company performance measurements, Project performance measurements, and Benchmarking Programs. Besides this classification, the indicators used in such measurements can be divided into: Result Indicators, Process Indicators and Leading Indicators (Suk et al., 2012).

The first part of the paper can be specified as focusing on the economic impact of development projects, examining their ability to create new jobs, increase productivity and promote innovation in the corporate environment. The second part analyses the impact of development projects on the efficiency of firms through the improvement of corporate processes, work optimization and the implementation of modern technological solutions. In the third part, we look at the social aspects of development projects, examining how they contribute to the digitalization of society, increase the availability of information and facilitate communication between people. The last part focuses on sustainable development and the ecological footprint of development projects. It addresses the question of how modern technologies can contribute to environmental protection and how development projects can be designed to minimize their negative impact on the planet.

The results of this paper can provide important information with respect to understanding the overall impact of development projects on various aspects of society and the economy.

2 The impact of development projects on social and economic performance

Development projects include the field of project finance. The developer is the investor in the project, but it is not the final investor. The final investor has an interest in owning the resulting project (either the resulting property directly or at least the company that owns the property), but does not want to take the risk of construction. However, even the developer does not usually carry out the construction itself; it is usually contracted out to a contractor, which is a construction company. In addition to the contractor, a number of other people are involved in the whole project, especially architects, designers, lawyers, etc. (Achour, 2004). Development projects have a major impact on social and economic performance at several different levels. Here are some ways in which development projects relate to these two aspects.

Development projects have a significant overlap with the external environment. So, as the project affects the external environment, it is affected by it. This influence is particularly evident in modifications and changes to infrastructure, manpower and other significant factors. In general, then, the rules that with the size and volume of the considered of a development project, the pressure and scrutiny from the other side increases. The public is attracted to long-term development projects to the public. Very often, then, in the actions of outside of the external environment, there are usually negative emotions and conflicting interests and related activities (Valach, 2006).

If it is a dynamic environment, then transformation is required and a change of transformational character in the units contained therein (Koleňáková et al., 2023).

However, it has become a worldwide trend in development projects that contractors are not keeping up with the expectations of the clients they serve, and indeed many residential contractors have failed to perform. Some studies confirms that the history of construction around the world is replete with projects that were completed late and cost overruns (Habimana and Kwena, 2021). Related to this, several other studies have reported that the construction industry is widely criticized for its scattered approach to projects and its inability to create effective teams. This has resulted in a reduction in the number of projects in terms of delivery efficiency (Egan, 1998; Egan, 2002; Egbuomwan and Anumba, 1998; Bakar et al., 2011).

2.1 Economic performance

Recently, there have been more fundamental changes in approaches to evaluating and measuring the economic performance of companies. Transition from standard financial indicators and models which are based on accounting profit into financial models that consider rather economic profit, market value and market criteria. Even so, attention is still paid to standard absolute accounting indicators such as economic results, costs, revenues, profitability and indebtedness indicators (Falisová, Glova and Andrejovská, 2023).

Innovation and competitiveness. Innovative projects can also bring new markets and business opportunities. Development projects that involve the creation of new products, services and infrastructure can be a driver of innovation and an essential element for increasing competitiveness in the marketplace.

Thanks to the competitive efforts of individual companies (and development companies), there is an effort in lucrative locations to differentiate themselves and to come to the market with something new and thus differentiate themselves from the competition and be desirable to their potential clients (local residents or clients who choose the location for their housing due to its prosperity). It is through this development that localities prosper. Kubík (2014) states that one of the main prerequisites of

strategic management is to monitor the competition and apply such measures so that the business remains competitive. In his article, Porter's analysis is practically applied to multiple enterprises. His conclusions declare the fact that it is very important for management to focus on competitive rivalry and the increasingly strong bargaining power of customers. In case a given enterprise experiences a decreasing tendency of competitive rivalry, it should use this situation to its advantage and focus on differentiating and increasing its competitiveness. Its practical part focused on an enterprise outside the real estate market, SCHOTT, a company that is focused on the hand assembly of industrial fiber optic products. Broadly speaking, his conclusions apply to management decision making in any business and therefore these factors need to be taken into account.

Labor market growth. The development of the software and IT industries contributes to job creation and labor market growth. Developers and IT specialists are highly sought-after professionals, which has an impact on economic performance in terms of employment and wages. In an era characterized by rapid technological progress and global interdependence, the relationship between development projects and labor market growth is increasingly complex. It highlights the need for a detailed understanding of the symbiotic relationship between development activities and the labor market in order to promote sustainable economic growth. The basic analysis includes several key dimensions:

Job creation and industrial dynamics: Examines the direct and indirect jobs created by development projects in different sectors; explores the impact of project types such as infrastructure development, technological innovation and social programs on specific sectors of the labor market.

Skills development and human capital enhancement: Examines how development projects contribute to skills development, training, and overall human capital enhancement; analyzes the match between project skill acquisition and the evolving demands of the current labor market.

Examines the impact of technology-oriented development projects on job roles, occupational structures and the emergence of new industries. Examines the potential disruptions and opportunities created by automation and artificial intelligence in the labour market (Pereira and Pereira, 2020).

Cost-effectiveness and productivity. Automation and process optimization can increase productivity and profitability. Productivity can be considered a key performance indicator. It examines how factors such as innovation, technology adoption and workforce efficiency contribute to higher levels of productivity.

Implementing innovative technologies and practices within development projects can significantly increase productivity and reduce costs by automating repetitive tasks. Effective communication and collaboration within the team and with the client can minimize misunderstandings and inefficient work, contributing to overall cost efficiency and productivity. Considering sustainability and the overall project life cycle can bring long-term savings and productivity gains (Danish, Khan and Haneklaus, 2023).

Further specifies that project cost control involves influencing the individual factors that create changes in the cost baseline, ensuring that the required changes are agreed, managing the actual changes as and when they occur, and monitoring cost performance to identify and understand variances, recording all relevant changes accurately, preventing inappropriate or unapproved changes from being included in cost calculations, even if they are changes that are inconsistent with the principles of reported costs, and working to bring expected cost overruns within acceptable limits (Bakar et al., 2011).

Within the Result Indicator it is possible to mention construction cost, by comparing the budget based on the plans and

specifications with the target cost of the project (Orihuela, Pacheco and Orihuela, 2017).

Revenue and profit. For example, the development and successful deployment of a software product can increase sales and generate new revenue.

2.2 Social performance

Economists commonly believe that competition is good for motivation and efficiency. But the question is whether market competition is also a driver of corporate social responsibility. Efforts to behave in a socially responsible manner come at a significant cost to companies: according to a 2015 report published by the Varkey Foundation, global Fortune 500 companies spent a total of \$19.9 billion on these efforts. It is possible that firms may be willing to make such expenditures purely out of altruism or to create a positive social image (Nickell, 1996; Benabou and Tirole, 2010).

Social performance generally encompasses a wide range of aspects such as community, environment, human rights, and treatment of employees. For example, companies operating in locations where there are problems in labor practices may compromise their competitive advantage, so they may focus on addressing these problems rather than environmental issues. Given the costs that arise from such social performance, firms should be judicious in choosing which dimensions to consider and on which to focus. The impact of market competition on firms' social performance may not be uniform across the CSR landscape (Leong and Yang, 2020).

"Result Indicators from the social area compares the social impact level caused by the design with the level set in the project baseline. Process Indicators consider compliance with design standards and the availability of spaces for social and productive life. Some of the Leading Indicators are the professional, ethical and moral responsibility towards compliance with the design standards that project designers and investors must have, as well as the good disposition to include spaces that allow people to socialize, relax and practice sports, and flexible productive spaces to promote the creation of cottage industries" (Orihuela, Pacheco and Orihuela, 2017).

Improving quality of life. This can include health apps, education apps, communication platforms and others that can improve access to information and services.

Thanks to the development of residential housing, individual districts are improving and becoming more lucrative places for families in their cities. Otherwise, the locations in question are steadily declining and interest in these addresses is dropping significantly. Economic and social theory refers to this as the 'broken windows theory'. Its authors are James Q. Wilson and George Kelling, who stated that in locations showing less interest from city residents, graffiti, street litter, broken windows, destroyed benches, etc. appear. In addition, people living in these locations lose interest and efforts to improve these areas (Roberts, 2014). With new construction, this situation can change in a major way. However, there must be interest in this from the leadership of the cities and municipalities concerned and, most importantly, from the development companies themselves.

The article by Brabec et al. (2015) is focused on the topic of the construction of residential units, which are being built in the Czech Republic mainly in Prague, but this trend is also spreading to other cities, e.g. Brno, Olomouc, Karlovy Vary and others. Even so, residential units in Prague represent more than 80% of all realized in the Czech territory. There can be many motivations to live in these closed "areas". Their research showed that when making decisions, it is not the presence of a security agency or the closeness of the unit that are above-standard elements, but expectations of a better quality environment and social conditions.

Development projects that support the creation of cultural and recreational facilities enhance the overall quality of life by providing opportunities for leisure, creativity, and community engagement (Fookes, 1987).

Within the indicators, it is possible to mention in this area Result Indicator is measured through Customer Satisfaction by comparing the estimation of customer satisfaction level. The satisfaction of the end user is one of the main goals of any construction project (Orihuela, Pacheco and Orihuela, 2017).

Employment and professional growth. Development projects create employment opportunities and promote professional growth. This can help people improve their social and economic position.

The relationship between real estate market development and employment was the subject of an article by Hanna et al. (2013). It should be noted that while the increase in demand may be due to employment opportunities, it may also be due to other factors. His study focused on rental housing. It is clear that changes in employment have caused changes in the demand and prices of rental housing. As the number of employment opportunities increases, the demand for housing will increase and so will the price of rent. Linked to this is the need to build new housing developments so that there is a balance in the area and the location remains desirable in the context of employment and training opportunities. Thus, developers are thinking in multiple directions in making decisions about their projects. In their paper, Kempa (2015) and other co-authors focus on this topic, looking at housing preferences and the properties themselves from the perspective of students. The results of this paper can serve mainly for residential investors who mainly direct their activities in locations of so-called "student cities". Kempa and his colleagues chose six universities in Poland where the research was conducted in the form of online questionnaires. The students were divided into two groups that differed in their field of study. Both groups agreed that the most important factors were the address of the property, the amenities in the area, the functionality, the layout and the size of the apartment.

Inclusiveness and Diversity. Responsible development projects can promote inclusiveness and diversity in the sector. This means taking into account the diversity and needs of different user groups. Initiatives aimed at strengthening social bonds, fostering community engagement, and promoting cultural activities can enhance the sense of community and social well-being. The literature review shows that housing is a key issue for specific groups of people. Inadequate housing can cause a sequence of interlocking difficulties, both at the public and personal level, ranging from narrowed employment choices, exposure to deteriorated living environments and relationships in suburban areas, deteriorated living environments and relationships in the area, time-consuming travel to the workplace, etc. A significant group may be people with disabilities for whom living in a home that does not meet basic standards in terms of building barriers to accessing the home or moving freely within the interior. Distance from social services, schools etc. can also be an important aspect, which can lead to some social exclusion (Alexiu, Ungureanu and Dorobantu, 2010).

Another paper, which although focused on IT technology, can no doubt be applied to development projects is presented by Rymarzak and Sieminska (2012). He focused on how a given project will affect the location in which it is developed and how the investors themselves (in our case the developer) approach the location decision. The choice of location can dramatically affect the success or failure of a given project or the operation of a firm. At the first stage, each investor must decide what the project will bring to its operations and, more importantly, to its future clients. In the case of building an apartment building to be rented out to students, the choice of the location must be focused on i.e. "Student Towns" where there is a large number of students. With this, the size of the individual apartments, their amenities and many other development tools to decide on the set strategy of the project. Otherwise, when it wants to offer a

luxury product - luxury housing units, it has to look for acquisitions in lucrative locations and associated with this is the quality of the building and its amenities.

Education and skills. Development projects can have a significant impact on education and skills, playing a crucial role in enhancing human capital, promoting lifelong learning, and contributing to overall socio-economic development. The goal is not only to increase access to education but also to ensure that the skills acquired align with the evolving needs of the labor market and society. In the context of education, environmental practices that need to be respected and educated about can also be mentioned.

The ecological footprint of development projects refers to the environmental impact and resource consumption associated with the planning, implementation, and operation of these projects. Assessing the ecological footprint is crucial for sustainable development, as it helps to understand and minimize the environmental consequences of human activities. Development projects often require significant resources, such as raw materials, water, and energy. Assessing and managing the sustainable use of these resources is essential to reduce the ecological impact. Construction and operation of development projects can contribute to greenhouse gas emissions and energy consumption. Implementing energy-efficient technologies and renewable energy sources helps minimize the ecological footprint. Development projects should consider the conservation of local flora and fauna. Implementing measures to protect biodiversity, such as habitat restoration and creating green spaces, helps offset ecological impacts.

Process Indicators can be listed the energy efficiency, water efficiency, promotion of sustainable transportation, and environmental pollution, whose considerations in the design phase reduce the environmental impact.

Some of the Leading Indicators are knowledge of low power and water-saving devices, knowledge of advanced monitoring devices for energy and water consumption, the environmental commitment of project designers and investors' knowledge of green transportation benefits, and knowledge of the reduction of heat islands, light pollution and rainwater management. Everything should lead to a reduction in the impact on the environment (Orihuela, Pacheco and Orihuela, 2017).

3 Conclusion

The impact of housing development on overall performance is a multifaceted and complex interplay of various economic, social and environmental factors. From the point of view of performance evaluation, it is clear that housing development is not just a physical transformation of the landscape, but an accelerator of broader socio-economic progress.

Well-planned housing projects and urban development initiatives contribute to creating safe, sustainable, and inclusive living spaces. It's important to note that successful development projects are often those that involve active community participation, respect cultural nuances, and address the specific needs and aspirations of the people they aim to serve. A holistic and inclusive approach is key to ensuring that development projects contribute positively to the quality of life.

By integrating ecological considerations into the planning and execution of development projects, stakeholders can work toward more sustainable and environmentally friendly outcomes, balancing human development needs with the preservation of ecosystems.

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Primary Paper Section: A

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CODE OF ETHICS FOR TEACHERS IN CATHOLIC SCHOOLS

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Abstract: Currently, there are many problems of an ethical nature, so it is necessary to look for possible solutions. One of them is the code of ethics, which forces people to reflect on their mission and the duties they have towards the environment that surrounds them. The code of ethics of a Catholic school teacher is specific in comparison with other professional codes, because in the behavior and actions of a Christian teacher, everyone should see an evangelical person.

Keywords: code of ethics, morality, ethics, catholic school teacher

1 Professional code of ethics

In recent decades, there has been a literal explosion in the creation of new ethical codes for educators, managers, scientists, engineers, interpreters, translators, university professors, and the like.¹ The professional code of ethics acts as an indicator for a person's professional activity. It is a certain norm of behavior among individuals of a given profession, but it also serves as a protection against unauthorized outside attacks.² It defines the moral space in which members of the profession move in accordance with notions of right and wrong, responsibility and justice. It reflects the interest of a group of individuals to regulate the actions of its members, based on certain rules that express the specific position and interest of the given group.³ "It functions as a self-regulator of the behavior of members of the given profession."⁴

The code of ethics of a Catholic school teacher could also be included among professional codes, because the code of ethics affects the professional activity, that is, the work of a Catholic school teacher. Finding an appropriate definition of a Catholic school teacher's code of ethics is not so easy. Perhaps the most suitable one is the definition of the school of St. Benedict from the United States of America: "The Catholic school teacher's code of ethics is a brief description of a person who grows in the faith, hope and love of Christ. This determines the attitude and practice of the Catholic primary school teacher in relation to the student, parents, society, and the profession. This code provides guidance on how a teacher should live, what goal he should strive for."⁵ In our opinion, the characteristic in question describes the essence of the ethical code of a Catholic school teacher and his way of life. As prof. Duda notes: "The way of life of a teacher at a Catholic school, both in private life and at school, must be in accordance with the morals of the Catholic Church."⁶ By the term "Catholic morals" we understand the science that, from the revelation of God, from the teachings of Jesus Christ and the Catholic Church, determines the rules of morality for a person, which he should follow in order to achieve his goal, i.e. eternal salvation.⁷ On the basis of the above, we could conclude that the ethical code of the teacher of the Catholic school of St. Benedict provides instructions for the teacher on how to achieve salvation, and as we can see, this is also the case in the statement of prof. Duda that in which he tells us that a Catholic school teacher should strive for eternal salvation. Both cases can be summarized in one sentence, and thus the ethical code of a Catholic school teacher presents us

with the requirements for a Catholic school teacher, according to which the teacher is called by the Creator to live and direct his actions in order to achieve eternal salvation.

The ethical code of a Catholic school teacher should be distinct from other professional codes, because in the behavior and actions of a Christian teacher, everyone should see a person who is armed with love and kindness, gives a living witness of a Christian and, as part of a Catholic school, performs a real civil and apostolic service.

2 Significance of the code of ethics in organizations

The importance of the code of ethics lies in the fact that it clarifies what behavior is expected from an individual in various situations, and at the same time its intention is to make/help individuals inculcate the ethical dimensions of their activities. The code of ethics is based on voluntary compliance with the required standard.⁸ The Code of Ethics does not regulate all variants of different situations that may arise, but its norms are often helpful in forming the judgments of individuals.⁹ The Code of ethics presents certain group, collective ethical standards and principles that should guide the activities of each individual in the organization. Each member is then under the influence not only of his own moral convictions, but also under the influence of social moral rules. His actions are regulated through various moral systems and ethical theories.¹⁰

From the point of view of the organization, the code of ethics is important in that it can eliminate undesirable practices that cause the organization to lose favor with employees, society and others and could lead to long-term economic losses, simplify the introduction of new procedures, clarify the organization's policy on certain moral issues such as employee testing, privacy, and the like, help directors resolve ethical issues for the best benefit of the organization, relieve directors of the burden of making a complex decision when there is little time to consider other possible aspects.¹¹

A good code of ethics can help the organization's leadership and management to solve specific problems. From the point of view of the organization's management, it can help to eliminate inappropriate practices that are the cause of a decrease in the interest of employees and the public and which can lead to economic losses, it may help to clarify the organization's policy on morally problematic issues, such as confidential information, accepting donations from other entities. Subsequently, it can facilitate innovation, help with the restructuring of the organization, strengthen the internal discipline of the organization, reduce the need for measures to detect immoral behavior and actions, prevent the management of the organization from abusing their position towards other employees and positively motivate the employees of the organization by strengthening the awareness that they work in an ethical environment, where certain rules apply to everyone. From the point of view of organizational management, the code of ethics can help to solve moral dilemmas and problems that occur in the management of the organization, it helps to face the immoral demands of superiors, subordinates in the organization and the public, it helps to defend one's decisions inside the organization, but also outside it, it simplifies intra-organizational communication and helps to speed up the detection of problems and detect potential fraud.¹²

¹ Paraph. REMIŠOVÁ, A., Profesijsné etické kódexy. In: *Filozofia*. no. 3 (2000), vol. 55, p. 218.

² Paraph. LACA, P., LACA, S. *Etika v kontexte sociálnych vied*. Brno : Institut medzioborových štúdií, 2013, p. 143.

³ Paraph. REMIŠOVÁ, A., Profesijsné etické kódexy. In: *Filozofia*. no. 3 (2000), vol. 55, p. 218.

⁴ REMIŠOVÁ, A., Profesijsné etické kódexy. In: *Filozofia*. no. 3 (2000), vol. 55, p. 218.

⁵ MEYERS, R. J. F., *Code of Ethics for the Catholic School Teacher*. In: www.cbsju.edu/education/student-resources/handbook/code-of-ethics (01.10.2023).

⁶ DUDA, J. *Učiteľ katolíckej školy*. In: *Právnické rozhovory*. Ružomberok : Pedagogická fakulta Katolíckej univerzity v Ružomberku, 2004, p. 40.

⁷ Paraph. PETRÁŠ, L., *Mravouka. Učebnica katolíckeho náboženstva pre vyššie triedy stredných škôl*. Trnava : SSV, 1948, p. 3.

⁸ Paraph. ČERNÁ, E., *Etika a zodpovednosť v podnikateľskej praxi*. Trnava : Bprint, 2007, p. 25.

⁹ Paraph. LUKNIČ, A. S., *Štvrtý rozmer podnikania - etika*. Bratislava : Slovak akademik press s.r.o., 1994, p. 196.

¹⁰ Paraph. REMIŠOVÁ, A., Profesijsné etické kódexy. In: *Filozofia*. no. 3 (2000), vol. 55, p. 218.

¹¹ Paraph. FERANECOVÁ, G., *Etika a etické kódexy v slovenských podnikoch*. Ružomberok : Verbum – vydavateľstvo KU v Ružomberku, 2014, p. 73.

¹² Paraph. FERANECOVÁ, G., *Etika a etické kódexy v slovenských podnikoch*. Ružomberok : Verbum – publisher KU v Ružomberku, 2014, p. 72.

Codes of ethics are also important because they cultivate the habit of evaluating various situations in the organization from a moral point of view, thus they help with the development of moral awareness. The American authors Bowie and Duska see the importance of the code of ethics in the following areas: the code of ethics motivates people to act in the same moral way, the code permanently and steadily guides what is right and what is wrong, the code is a guide, especially in unclear situations, it not only shows the right direction within behavior of employees, but it also eliminates possible transgressions of their superiors, the rules within ethical codes should help the social responsibility of the organization, the development of ethical codes is in the interest of the organizations themselves.¹³

The teacher's code of ethics is also of great importance for an organization such as a Catholic school. In addition to the mentioned advantages, we will also mention others that are important for the Catholic school. It happens that some teachers lack awareness of the essence of a Catholic school, in some cases the teaching of the church alone is not enough. It is insufficient not because of imperfection, but because of wrong or no understanding on the part of Catholic school teachers. Sometimes it is simply laxity. It is the code of ethics that helps them to realize that the Catholic school is imbued with the Christian spirit and its main goal is to raise a Christian. If a Catholic school teacher failed in his actions, he could damage the name of the Catholic school. The teacher has considerable authority in society, but in the case of a Catholic school teacher, it is an authority that everyone associates with the teachings of the church and the church itself. Thus, every transgression of a Catholic school teacher is even more serious, and somehow subconsciously we all put more emphasis and demands on observing his morals. It can be said that his less serious actions will be condemned by society more seriously than the more serious offense of an "ordinary" teacher. The code of ethics helps many Catholic school teachers to understand that the center of their profession is Christ, the model according to which a Christian should act and give a living witness to God's love through his actions. Through their behavior and actions, teachers contribute the most to the special character of a Catholic school.

The ethical code of a Catholic school teacher is a "compass that shows the right direction", therefore a good ethical code should contain moral obligations and patterns of behavior in the teacher's relationship with God, the teacher's relationship with himself, the teacher's relationship with students, the school and colleagues, the teacher's relationship with parents and society. We could say that a code of ethics is of great importance for an organization such as a Catholic school as it helps to create a spiritual community in which all those involved live not next to each other but together, not against each other but with each other, not for themselves, but for each other.

3 Employee code of ethics and legal aspects

Currently, a lot of attention is paid to issues of a moral-legal type. We often encounter moral transgressions of employees, and the fact that the employee is not actually subject to official punishment. Therefore, we consider it important to pay attention to the code of ethics and legal aspects. Many people nowadays confuse legal standards with ethical standards. We find it necessary to specify them in more detail.

Legal norms are rules of behavior determined in a special, state-recognized form, the observance of which can be enforced by the state power and are the only ones binding for the entire society. They refer to a precisely defined area of human activity.¹⁴ Legal norms bind every member of society. In case of their violation, the degree of offense and punishment are considered.¹⁵

Standards of ethical behavior serve as guidelines for the professional behavior of employees and they are determined by the code of ethics. These standards represent rules that members of a certain profession abide by and that are binding in nature. They are not codified, so they can react more quickly to possible changes.¹⁶ They represent an obligation to which a person submits voluntarily, thanks to free will. A person is able to freely decide how to act.¹⁷ Violation of moral standards is subject to official punishment only if it is also a violation of legal laws.¹⁸

The question arises, if a Catholic school teacher violates ethical standards that cannot be defined from a legal aspect, can he be sanctioned or perhaps dismissed from his job? Example: Currently, gender theology is heavily promoted in the liberal world and even some teachers at a Catholic school can relate to it to a certain extent. For example, the attitude towards gay marriage. If, within the framework of the teaching process, the teacher takes a position on this matter that is not in accordance with the teachings of the Catholic Church, he has not violated the work regulations or other legal regulations in the field of labor law, but he has violated the code of ethics, which binds him to act in accordance with the morals and ethics of the Catholic Church throughout the educational process. For compliance and a professional approach to solving this problem, it is important to specify the ethical code of the Catholic school teacher so that it is a national document that can be used in managerial decision-making in the context of other labor-legal norms. "Although there is an organization of relationships in society, institutions that are regulated exclusively by law or only by moral standards, this does not mean that the force of morality cannot become a law-making force in a certain social situation. Similarly, law, as a way of fair regulation of social relations, has a positive, moral charge and can manifest itself as a moral force."¹⁹

In conclusion, we can state that the code of ethics has gradually developed in our society. Currently, many authors understand the code of ethics as a set of moral requirements for a certain group of people, in a certain environment. Codes of ethics differ from each other according to individual priorities. The ethical code of the Catholic school teacher offers us the standards according to which this teacher is called by God to guide his actions and behavior in order to achieve eternal salvation. The Catholic school teacher's code of ethics can be used in managerial decision-making, in connection with other labor law standards. A Catholic school is simply a big family, an important part of which are the teachers who are supposed to know and obey the rules.

4 The need for a code of ethics in a Catholic school – research

4.1 Research objectives

The primary objective of the research is to determine whether teaching staff consider the code of ethics necessary and whether they have encountered violations of ethical principles in a Catholic school. The secondary objective is to determine whether, according to educators, violations of ethical principles in the exercise of their profession should be sanctioned.

4.2 Methodology

The research was carried out at 19 Catholic schools of the Spiš Diocese in Slovakia. The research was carried out among primary level teachers of Catholic schools in the form of a questionnaire. The respondents to the survey were of all ages.

¹³ Paraph. REMIŠOVÁ, A., *Podnikateľská etika*. Bratislava: EKONÓM, 1997, p. 200.

¹⁴ Paraph. FERANECOVÁ, G., *Etika a etické kódexy v slovenských podnikoch*. Ružomberok: Verbum – vydavateľstvo KU v Ružomberku, 2014, p. 46.

¹⁵ Paraph. MIEDZGOVÁ, J., *Základy etiky*. Bratislava: Slovenské pedagogické nakladateľstvo, 1994, p. 59.

¹⁶ Paraph. FERANECOVÁ, G., *Etika a etické kódexy v slovenských podnikoch*. Ružomberok: Verbum – vydavateľstvo KU v Ružomberku, 2014, p. 46.

¹⁷ MACHALOVÁ, T., *Vzťah etiky, morálky a práva*. In: *Praktické otázky etiky a morálky*, Bratislava: PVT, 1998, p. 40.

¹⁸ MIEDZGOVÁ, J., *Základy etiky*. Bratislava: Slovenské pedagogické nakladateľstvo, 1994, p. 59.

¹⁹ MACHALOVÁ, T., *Vzťah etiky, morálky a práva*. In: *Praktické otázky etiky a morálky*, Bratislava: PVT, 1998, p. 42.

Altogether, there was a total of 101 primary level teachers participating in the research.

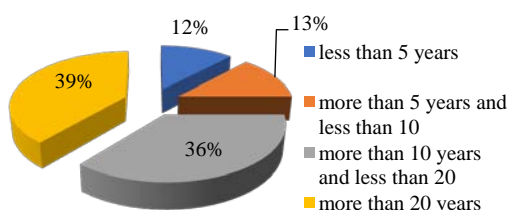
4.3 Analysis of research results

Question no.1 aimed to find out how many years of teaching experience do the respondents have.

Table 1 Length of teaching experience

Length of teaching experience	number of responses	
	abs.	in %
less than 5 years	12	11,9
more than 5 years and less than 10	13	12,9
more than 10 years and less than 20	36	35,6
more than 20 years	40	39,6
TOGETHER	101	100,0

Figure no. 1 Length of teaching experience



From the responses of primary level teachers of Catholic schools, it is clear that those who have been working as teachers for less than 5 years comprise 11.9%, the teachers with more than 5 years and less than 10 years of teaching experience comprise 12.9%, 35.6%, of the respondents are the teachers who have more than 10 and less than 20 years of experience and those with over 20 years of teaching experience comprises 39.6% of all respondents.

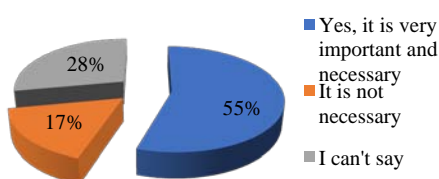
From the above, it is clear that the least of the respondents who work as teachers are those whose length of teaching experience is less than 5 years and the highest number of the respondents are those with over 20 years of teaching experience.

By question no. 2 we wanted to find out whether, according to primary level teachers, it is necessary for a Catholic school as an employer to have a code of ethics for teachers.

Table no. 2 The need for a teacher's code of ethics in a Catholic school

The need for a teacher's code of ethics in a Catholic school	number of responses	
	abs.	in %
Yes, it is very important and necessary	56	55,4
It is not necessary	17	16,8
I can't say	28	27,7
TOGETHER	101	100,0

Figure no. 2 The need for a teacher's code of ethics in a Catholic school

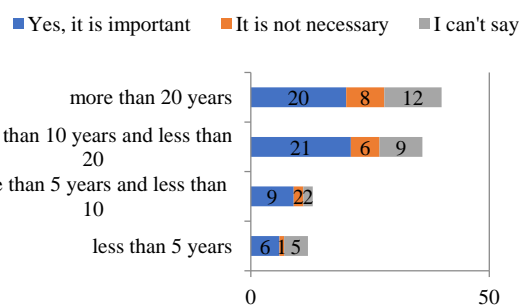


The majority of respondents – 55.4% agree that it is very important and necessary for a Catholic school to have a teacher's code of ethics. Out of all respondents, 16.8% said it was not necessary and 27.7% could not comment on the issue. We find it interesting to point out the relationship between question no. 1 and question no. 2, and thus the need for a teacher's code of ethics and the length of the teaching experience.

Table no. 3 Correlation of question 1 and question 2

The need for a teacher's code of ethics in a Catholic school	Teachers with teaching experience								TOGETHER	
	less than 5 years		more than 5 years and less than 10		more than 10 years and less than 20		more than 20 years			
	abs.	in %	abs.	in %	abs.	in %	abs.	in %	abs.	in %
Yes, it is important	6	50,0	9	69,2	21	58,3	20	50,0	56	55,4
It is not necessary	1	8,3	2	15,4	6	16,7	8	20,0	17	16,8
I can't say	5	41,7	2	15,4	9	25,0	12	30,0	28	27,7
TOGETHER	12	100,0	13	100,0	36	100,0	40	100,0	101	100,0

Figure no. 3 Correlation of question 1 and question 2



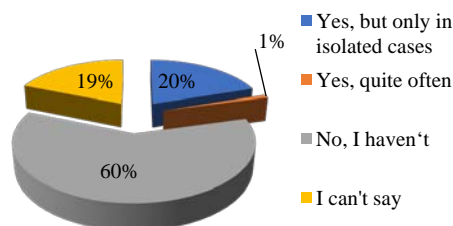
As many as 20 teachers with more than 20 years of teaching experience consider the teacher's Code of ethics necessary, 8 teachers think it is not necessary and 12 teachers have not opinion on the issue.

Question no. 4 aimed to find out whether teachers have encountered violations of ethical principles by teachers in the exercise of their profession at schools where they are teaching.

Table no. 4 Violation of ethical principles by professional teachers

Violation of ethical principles by professional teachers	number of responses	
	abs.	in %
Yes, but only in isolated cases	20	19,8
Yes, quite often	1	1,0
No, I haven't	61	60,4
I can't say	19	18,8
TOGETHER	101	100,0

Figure no. 4 Violation of ethical principles by professional teachers



Responses to question 4 have shown that 19.8% of the respondents have encountered violations of ethical principles by teachers in the exercise of their profession, 1% have encountered

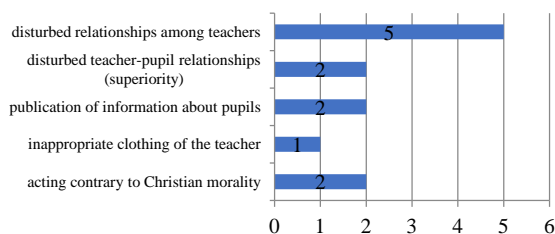
them quite often, 60% have not encountered any violations of ethical principles and 19% could not comment on the matter.

In question no. 5 we wanted to find out, in what situations there was a violation of ethical principles by the teachers.

Table no. 5 Violation of ethical principles by teachers

Violated ethical principles by teachers	number of responses	
	abs.	in %
disturbed relationships among teachers	5	5,0
disturbed teacher-pupil relationships (superiority)	2	2,0
Publication of information about pupils	2	2,0
inappropriate clothing of the teacher	1	1,0
acting contrary to Christian morality	2	2,0
TOGETHER	12	12,0

Figure no. 5 Violation of ethical principles by teachers



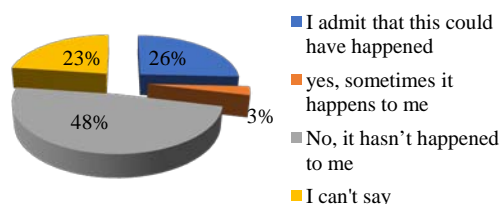
Of the answers of the interviewed teachers who commented on the question, i.e. 12 teachers, 5 said that disturbed relationships between teachers are frequent, 2 teachers observed disturbed teacher-pupil relationships, 2 teachers mentioned inappropriate disclosure of information about pupils, 1 chose the option inappropriate clothing and 2 teachers said that it was acting contrary to Christian morality. Thus, we can observe that even teachers in Catholic schools experience situations that are contrary to ethical principles.

In question no. 6 we asked the respondents whether they have violated some ethical standards in a Catholic school.

Table. no. 6 Personal violation of ethical standards

Personal violation of ethical standards	number of responses	
	abs.	in %
I admit that this could have happened	26	25,7
yes, sometimes it happens to me	3	3,0
No, it hasn't happened to me	49	48,5
I can't say	23	22,8
TOGETHER	101	100,0

Figure no. 6 Personal violation of ethical standards



Answers to the question showed that 25.7% of the respondents admit that this could have happened, 3% of the teacher sometimes violate ethical standards, 48.5% say it hasn't

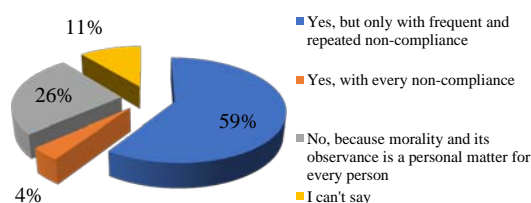
happened to them and 22.8% were unsure whether it has ever happened to them or not.

In question no. 7, we wanted to find out what opinion Catholic school teachers have on whether non-compliance with ethical principles in the exercise of the teaching profession should be sanctioned or not.

Table no. 7 Sanctioning non-compliance with ethical principles in the exercise of the teaching profession

Sanctioning non-compliance with ethical principles in the exercise of the teaching profession	number of responses	
	abs.	in %
Yes, but only with frequent and repeated non-compliance	60	59,4
Yes, with every non-compliance	4	4,0
No, because morality and its observance is a personal matter for every person	26	25,7
I can't say	11	10,9
TOGETHER	101	100,0

Figure no. 7 Sanctioning non-compliance with ethical principles in the exercise of the teaching profession



We could conclude that frequent and repeated non-compliance with ethical principles in the exercise of the profession should be sanctioned, which was agreed with by more than half of the respondents.

4.4 Summary of research results

In conclusion we could say that our research has shown that nowadays teachers in Catholic schools also encounter violations of moral principles and, therefore, consider a code of ethics necessary. Educational staff are also of the opinion that frequent violations of ethical principles should be sanctioned.

5 Conclusion

These studies, combined with research into Catholic school teachers' attitudes towards moral principles, confirm the importance of a code of ethics in Catholic schools. The successful performance of any activity requires a certain motivation, and for a teacher at a Catholic school, faith in God is the strongest source of motivation.

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Primary Paper Section: A

Secondary Paper Section: AM, AA

THE EFFECT OF THE INCLUSION OF FIRST AID IN TEACHER EDUCATION

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Abstract: This article aims to analyze, through a questionnaire, future teachers' knowledge and opinions regarding first aid, and to assess the inclusion of a mandatory first-aid course, the content of which was influenced by statistical data of the South Bohemian Emergency Medical Service and teachers' statistics (Hrušková et al., 2022). Students of the Faculty of Education (N=227) from South Bohemia (municipalities with different populations and, with regard to the gender ratio in students, mostly women) filled out questionnaires before and after a first-aid course in 2023. Through the questionnaire survey (a) significant differences were found in the mean values of knowledge of first aid in sum between all subgroups of students ($p \leq 0.05$), (b) in the level of knowledge of first aid for cardiopulmonary resuscitation (CPR), traumas, and acute conditions of chronic diseases ($p \leq 0.05$), and (c) in the level of knowledge of each first-aid item individually ($p \leq 0.05$). In general, completing our first-aid course is essential for all our students ($p \leq 0.05$), even for those who have already completed some previous first-aid course.

Keywords: first aid, education, teachers, cardiopulmonary resuscitation, trauma, acute condition, social science

1 Introduction

First pre-medical aid is defined as the first and immediate assistance given to any person with either a minor or serious illness or injury, with care provided (a) to preserve life, (b) prevent the condition from worsening (e.g. circulatory failures), or (c) to promote recovery. It includes initial intervention before professional medical help is available, such as stopping massive bleeding, helping during choking, and (if necessary) performing cardiopulmonary resuscitation (CPR) while waiting for an ambulance, as well as the complete treatment of minor conditions, such as applying disinfectant and a plaster to a cut. First aid is generally performed by someone with basic medical training, who must consider also his or her own safety and the safety of other people present (FAM, 2021; Kelnarová, et al., 2012; Hrušková & Gutvirth, 2010).

Any human being is always expected to provide basic assistance, especially in case of emergency. That is not just a moral obligation, but also a legal requirement, which includes calling the Emergency Medical Service (in the Czech Republic 155) for professional help (§ 150, No. 40/2009 Coll.). In addition, teachers are obliged to protect the safety and health of all pupils (§ 22b, No. 561/2004 Coll.). Also school administration has an obligation (a) to guarantee first aid to pupils and employees and (b) to educate pupils and staff about first aid (§ 102 and § 103, No. 262/2006 Coll.), although it is expressed widely as an obligation of the employer's management in relation to employees.

In the field of first-aid education, the most relevant source is the European Resuscitation Council (ERC Guidelines, 2015; 2021). These guidelines are updated usually every five years and reflect the latest scientific findings in the field of first aid. Other publications and projects subsequently build on these findings (e.g. Greif et al., 2021; British Red Cross, 2022; Truhlář et al., 2021; SBR Project, 2022).

The importance of targeted, regular first-aid training for future teachers was highlighted from the perspective of Czech teachers (Kuba & Havlíková, 2023; Kuba et al., 2019), through the curriculum (Bakke et al., 2017), and professional methodology (Greif et al., 2021).

In the present circumstances, first-aid course is mandatory for students (future teachers) in the pre-primary, primary, and secondary levels of education) at the Faculty of Education. The aim of our research was to analyze, through a questionnaire, the

knowledge and opinions of students (future teachers) regarding first aid and to evaluate differences in the pre-course and post-course knowledge of first aid. Another aim of the study was to assess the inclusion of a mandatory first-aid course, the content of which was influenced by statistical data of the South Bohemian Emergency Medical Service and teachers' statistics (Hrušková et al., 2022).

2 Material and methods

The study was conducted in 2023 at Faculty of Education (University of South Bohemia) and between September 2018 and June 2019 (South Bohemian Emergency Rescue Service). Students (N=227) were contacted personally and via email. A one-day first-aid course led by Emergency Rescue Service medics is a mandatory part of the curriculum for future teachers at the Faculty of Education. Students are trained according to the current recommendations of the European Resuscitation Council for teaching first aid (Greif et al., 2021). Students learn theory and practical skills, including simulations. All participants filled out the same questionnaire within one week before (pre-test) and one week after the course (post-test). They were informed about the objective and methodology of the study and were asked to provide express written consent to use their anonymized data. The data were collected using a questionnaire in written and electronic form.

The questionnaire contains 27 questions about the first-aid procedures recommended at the time of data collection (i.e. ERC Guidelines, 2021). With regard to the CPR theme, the following were included: performing CPR on children (control of consciousness and breathing, cardiopulmonary resuscitation, rescue breathing), massive bleeding, and choking. For the trauma theme the following were included: wrist/elbow/ankle/knee injuries, concussion, fractures caused by the child falling, burns and scalds, penetrating trauma associated with foreign bodies, nosebleed/epistaxis, the child getting the wind knocked out of him/her, abrasions and lacerations, and a knocked-out tooth. For the non-trauma theme the following were included: asthma attack, convulsive state/epilepsy, hypoglycaemia/diabetes mellitus, anaphylaxis, and hyperventilation/panic attack. With regard to other items, the following were included: nausea, headaches, syncope and collapse, fever, removing a tick, acute intoxication, drowning, and psychological support. Only one response was deemed correct, and marking such an item was evaluated with one point, while other response variants were graded as zero points. The questionnaire also contains items for expressing whether students provided first aid or whether students are/were in contact with current/former classmates or loved ones with chronic diseases.

The subgroup "Teaching children 3–6 years old" includes future teachers at pre-primary schools, the subgroup "Teaching children 7–11 years old" future teachers at primary schools (i.e. elementary school grades 1 to 5), and the subgroup "Teaching children 12–15 years old" includes future teachers at lower secondary schools (i.e. elementary school grades 6 to 9). Table 1 (below) shows numbers of students.

The group of students was divided into (a) a subgroup with no previous first-aid course (126 students, 56% of the group, "no pre-course") and (b) a subgroup who had undergone one or more previous first-aid courses (101 students, 44% of the group, "with pre-course").

The anonymized data (cases during school hours) were collected between September 2018 and June 2019 by the South Bohemian Emergency Medical Service.

Table 1: Numbers of students.

	No previous first-aid course	One or more previous first-aid courses	In total
Teaching children 3–6 years old	13 (56%)	10 (44%)	23 (100%)
Teaching children 7–11 years old	34 (57%)	26 (43%)	60 (100%)
Teaching adolescents 12–15 years old	79 (55%)	65 (45%)	144 (100%)
In total	126 (56%)	101 (44%)	227 (100%)

Source: Authors.

The points scored in the pre-test and post-test in respect to the previous first-aid course (the subgroup “no pre-course” and the subgroup “with pre-course”) were analysed using repeated-measures ANOVA (total points scores and separately points in different first-aid topics). Same method was used for analysis of the points scored in the hypoglycaemia item and the convulsive state item, but in respect to the subgroups with and without direct knowledge of people with diabetes/epilepsy). Because maximum points in those two items is low, the analysis of number of correct answers according to the direct knowledge of people with/out diabetes/epilepsy was also done by χ^2 test. All analyses were conducted in Statistica 14 (Tibco Software, CA, USA). The level of significance α was set as 0.05.

3 Results

3.1 Providing first aid is not unique (excluding minor superficial injuries)

Students stated in the questionnaire whether they provided first aid. The frequency of affirmative answers within each subgroup of future teachers of pre-primary, primary, and lower secondary schools in percentage is shown in Table 2 (below).

Table 2: Frequency of students provided first aid^o (affirmative answers in percentage).

		No previous first-aid course	One or more previous first-aid courses
Teaching children 3–6 years old	trauma	0 (0%)	9 (39%)
	non-trauma ^{oo}	0 (0%)	4 (17%)
Teaching children 7–11 years old	trauma	5 (8%)	13 (22%)
	non-trauma ^{oo}	7 (12%)	9 (15%)
Teaching adolescents 12–15 years old	trauma	2 (1%)	7 (5%)
	non-trauma ^{oo}	4 (3%)	7 (5%)

Note: ^o Minor superficial injuries are excluded., ^{oo} Non-traumatic acute conditions. Source: Authors.

In this questionnaire item minor superficial injuries were excluded. Students with previous first-aid training reported providing first aid more frequently than those who had not passed any first-aid course. Students with first-aid training could function as tutors at educational activities or camps, consequently they could provide first aid more frequently. Also, students with a first-aid course could be less afraid to help someone (Kuba & Havlíková, 2023).

3.2 Incidence of chronic diseases in current/former classmates or loved ones

Students reported in the questionnaire whether they are/were in contact with current/former classmates or loved ones with chronic diseases. The frequency of affirmative answers, expressed as percent, is shown in Table 3.

Table 3: Chronic diseases in current/former classmates or loved ones (affirmative answers in percentage).

	Teaching children 3–6 years old	Teaching children 7–11 years old	Teaching adolescents 12–15 years old
At least one chronic disease	100%	100%	100%
Food allergy	65%	66%	80%
Diabetes mellitus	45%	64%	66%
Nosebleed/epistaxis	50%	58%	57%
Allergy to insect bites	45%	42%	63%
Asthma	40%	46%	54%
Epilepsy	25%	36%	32%

Source: Authors.

All students are/were close with at least one chronic disease in current/former classmates or loved ones. Students reported in the questionnaire that they are/were close with the following selected chronic diseases (the frequency of affirmative answers of all students): food allergy (70%), diabetes mellitus (58%), nosebleed/epistaxis (55%), allergy to insect bites (50%), asthma (47%), and epilepsy (31%).

Future teachers at lower secondary schools reported all chronic diseases more often than future teachers at pre-primary and primary schools, but we could consider this phenomenon to be the result of coincidence.

3.3 Level of knowledge of first aid between subgroups of students and the effect of previous first-aid training

The level of knowledge of first-aid procedures was assessed through standard first-aid questions (27 items) in one part of the questionnaire. Each first-aid item was worth one point for one correct answer.

The level of knowledge of basic first aid before our first-aid course was insufficient (the mean value was 66%). The highest scores (mean values in percentage) were calculated for fall from a height (96%), suffocation (94%), fever (91%), headache (90%), and psychological support (90%). On the other hand, the lowest scores (mean values in percentage) were calculated for the CPR item (an alarming 16%), a knocked-out tooth (18%), shortness of breath (33%), nosebleed (41%), and panic attack (42%). The level of knowledge of basic first aid after our first-aid course was more sufficient (the mean value in percentage was 81%).

The differences in knowledge of first aid before and after the first-aid course was statistically significant when assessed for all students in the overall results ($p \leq 0.05$), for all subgroups (“Teaching children 3–6 years old”, “Teaching children 7–11 years old”, and “Teaching children 12–15 years old”) in the overall results ($p \leq 0.05$ in all comparisons) as well as for all subgroups in individual items ($p \leq 0.05$ in all comparisons).

The differences in knowledge of first aid before our first-aid course were calculated for (a) a subgroup with no previous first-aid course (126 students, 56% of the group, “no pre-course”) and (b) a subgroup with one or more previous first-aid courses (101 students, 44% of the group, “with pre-course”). Students with one or more previous first-aid courses scored higher, but the differences were not significant in all comparisons (the sum: $t =$

1.627, $df = 225$, $p = 0.105$; the CPR theme: $t = 0.186$, $df = 225$, $p = 0.853$; the trauma theme: $t = 1.6$, $df = 225$, $p = 0.111$; the non-trauma theme: $t = 1.737$, $df = 225$, $p = 0.084$).

An analysis of the results before and after our course in two subgroups divided according to the number of previous first-aid courses is presented below (Figure 1). The differences in knowledge of first aid before our first-aid course “pre-test (SUM1)” and after our first-aid course “post-test (SUM2)” were calculated for (a) a subgroup with no previous first-aid course (126 students, 56% of the group, “no pre-course”) and (b) a subgroup with one or more previous first-aid courses (101 students, 44% of the group, “with pre-course”).

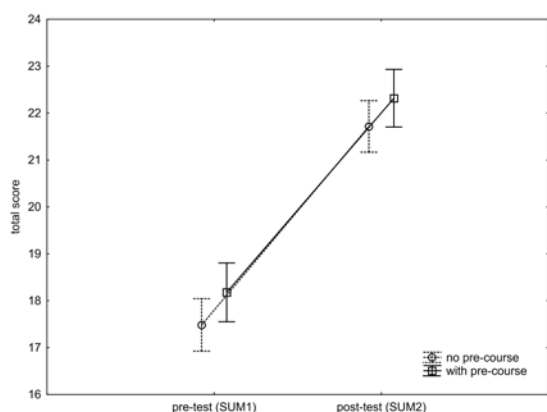


Figure 1: The effect of previous first-aid training. An attendance of the first-aid course increased significantly the total score in both research groups (details in text). Source: Authors.

In general, the effect of having completed our first-aid course is statistically highly significant ($F_{1, 225} = 258.13$; $p < 10^{-17}$). The increase did not differ depending on previously completed first-aid courses ($F_{1, 225} = 0.03$; $p = 0.86$).

3.4 Level of knowledge of first aid – the CPR theme, the trauma theme, and the non-trauma theme

The differences in knowledge of first aid before our first-aid course (pre-test) and after our first-aid course (post-test) were calculated for the CPR theme, the trauma theme, and the non-trauma theme between the subgroup with no previous first-aid training (“no pre-course”) and with previous first-aid training (“with pre-course”).

For the CPR theme (Figure 2) the following were included: CPR in children (control of consciousness and breathing, cardiopulmonary resuscitation, rescue breathing), massive bleeding, and choking (a quite frequent reason for resuscitation in young children).

An analysis of the results for the CPR theme (“pre-test (CPR1)” and “post-test (CPR2)”) in two subgroups divided according to the number of previous first-aid courses (“no pre-course” and “with pre-course”), is presented below (Figure 2).

With regard to the trauma theme (Figure 3), the following were included: wrist/elbow/ankle/knee injuries, concussion, fractures caused by the child falling, burns and scalds, penetrating trauma associated with foreign bodies, nosebleed/epistaxis, the child getting the wind knocked out of him/her, abrasions and lacerations, and a knocked-out tooth.

Traumas are ubiquitous. Their frequency is influenced by the rules for prevention, but partly they are the result of coincidence. An analysis of the results for the trauma theme (“pre-test (trauma1)” and “post-test (trauma2)”) in two subgroups divided according to the number of previous first-aid courses (“no pre-course” and “with pre-course”), is presented below (Figure 3).

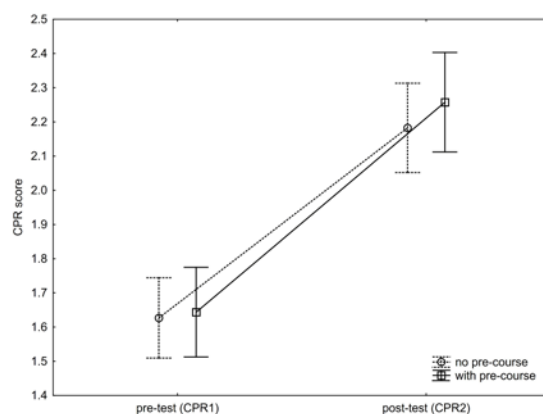


Figure 2: Level of knowledge of first aid – the CPR theme. An attendance of the first-aid course increased significantly the CPR score in both research groups (details in text). Source: Authors.

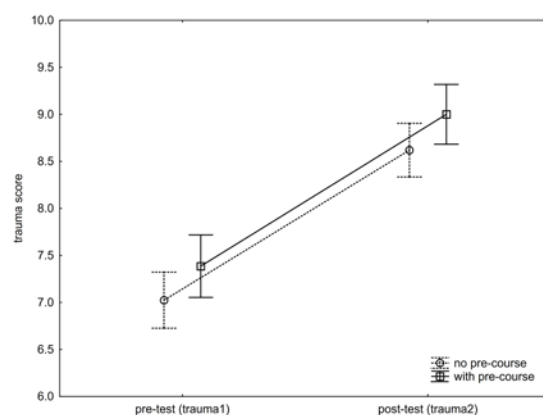


Figure 3: Level of knowledge of first aid – the trauma theme. An attendance of the first-aid course increased significantly the trauma score in both research groups (details in text). Source: Authors.

For the non-trauma theme (Figure 4) the following were included: asthma attack, convulsive state/epilepsy, hypoglycaemia/diabetes mellitus, anaphylaxis, and hyperventilation/panic attack.

An analysis of the results for the non-trauma theme (“pre-test (non-trauma1)” and “post-test (non-trauma2)”) in two subgroups divided according to the number of previous first-aid courses, is presented below (Figure 4).

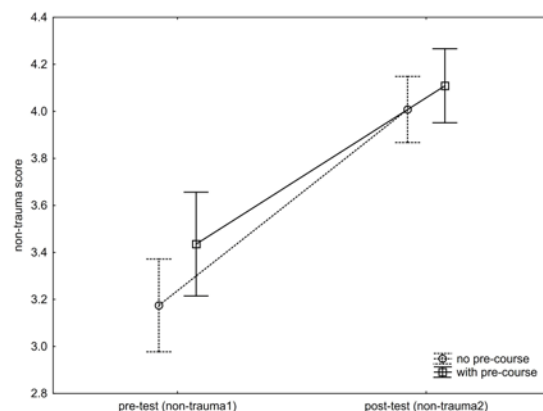


Figure 4: Level of knowledge of first aid – the non-trauma theme. An attendance of the first-aid course increased significantly the non-trauma score in both research groups (details in text). Source: Authors.

3.5 Level of knowledge of first aid in the hypoglycaemia/diabetes mellitus theme and the convulsive state/epilepsy theme

3.5.1 The hypoglycaemia/diabetes mellitus theme

Students with/without current/former classmates or loved ones with diabetes responded to the hypoglycaemia item within one week before (pre-test) and one week after the course (post-test). The subgroup “diabetes 0” includes students without current/former classmates or loved ones with diabetes, while the subgroup “diabetes 1” includes students with current/former classmates or loved ones with diabetes. Table 4 shows numbers of students with/without correct responses in the hypoglycaemia item a week before the first-aid course, while the level of knowledge with regard to the hypoglycaemia item is presented in Figure 5 (below).

Table 4: Numbers of students with/without correct responses in the hypoglycaemia item a week before the first-aid course.

	Hypoglycaemia – correct response	Hypoglycaemia – incorrect response	In total
Students without current/former classmates or loved ones with diabetes	54	18	72
Students with current/former classmates or loved ones with diabetes	99	26	125
In total	153	44	197

Source: Authors.

Contact with a diabetic person did not affect the frequency of correct responses in the hypoglycaemia item before our first-aid course ($\chi^2 = 0.465$; $df = 1$; $p = 0.495$).

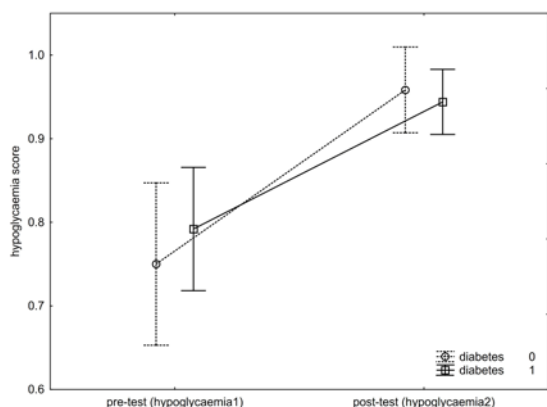


Figure 5: Level of knowledge of first aid in the hypoglycaemia item. An attendance of the first-aid course increased significantly the hypoglycaemia score irrespective of previous direct knowledge of persons with diabetes (details in text); “diabetes 0” – the subgroup without current/former classmates or close relatives with diabetes; “diabetes 1” – the subgroups with current/former classmates or close relatives with diabetes. Source: Authors.

The effect of our first-aid course is significant ($F_{1, 195} = 32.142$; $p < 10^{-7}$), but the effect of contact with a diabetic person is not significant ($F_{1, 195} = 0.133$; $p = 0.715$). The improvement in knowledge of the hypoglycaemia item was slightly higher in students who are/were not in contact with a diabetic person (“diabetes 0”), but the difference against the subgroup of

students with current/former classmates or loved ones with diabetes (“diabetes 1”) is not statistically significant ($F_{1, 195} = 0.786$; $p = 0.377$).

3.5.2 The convulsive state/epilepsy theme

Students with/without current/former classmates or loved ones with epilepsy responded to the convulsive state item within one week before (pre-test) and one week after the course (post-test). The subgroup “epilepsy 0” includes students without current/former classmates or loved ones with epilepsy, while the subgroup “epilepsy 1” includes students with current/former classmates or loved ones with epilepsy. Table 5 shows numbers of students with/without correct responses in the convulsive state item a week before the first-aid course, while the level of knowledge for the convulsive state item is presented in Figure 6 (below).

Table 5: Numbers of students with/without correct responses in the convulsive state item a week before the first-aid course.

	Convulsive state – correct response	Convulsive state – incorrect response	In total
Students without current/former classmates or loved ones with epilepsy	84	49	133
Students with current/former classmates or loved ones with epilepsy	48	16	64
In total	132	65	197

Source: Authors.

Contact with an epileptic person did not affect the frequency of correct responses in the convulsive state item before our first-aid course ($\chi^2 = 2.74$; $df = 1$; $p = 0.098$).

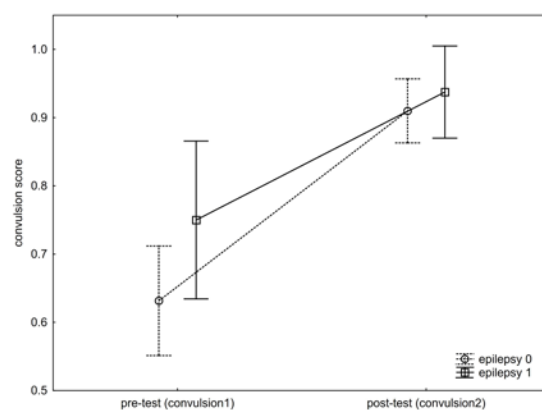


Figure 6: Level of knowledge of first aid in the convulsive state item. An attendance of the first-aid course increased significantly the convulsion score irrespective of previous direct knowledge of persons with epilepsy (details in text); “epilepsy 0” – the subgroup without current/former classmates or loved ones with epilepsy; “epilepsy 1” – the subgroup with current/former classmates or loved ones with epilepsy. Source: Authors.

The effect of our first-aid course is significant ($F_{1, 195} = 36.215$; $p < 10^{-8}$), but the effect of contact with an epileptic person is not significant ($F_{1, 195} = 2.778$; $p = 0.097$). The improvement in knowledge of the convulsive state item was slightly higher in students who are/were not in contact with an epileptic person (“epilepsy 0”), but the difference against the subgroup of students with current/former classmates or loved ones with

epilepsy ("epilepsy 1") is not statistically significant ($F_{1, 195} = 1.374$; $p = 0.243$).

In general, contact with a diabetic or an epileptic person did not affect the frequency of correct responses from our students in the hypoglycaemia/convulsive state items.

3.6 Changes in the health status of children and adolescents managed by the South Bohemian Emergency Rescue Service

Demographic statistics for the South Bohemian Region (as of 31 December 2018; CSOEdu, 2020) state the following numbers of children and adolescents: nursery schools (i.e. pre-primary schools) 23,060 children, basic schools (i.e. primary and lower-secondary schools) 57,070 pupils, secondary schools (i.e. higher-secondary schools) 25,939 pupils. The distribution of the population by sex and age in the South Bohemian Region (as of 31 December 2018; CSOPop, 2020) is the following: a total of 642,133 people, including 26,833 children aged 1–4 years, 34,037 children aged 5–9 years, 33,628 adolescents aged 10–14 years and 29,020 adolescents aged 15–19 years.

The anonymized data (cases during school hours) were collected between September 2018 and June 2019 by the South Bohemian Emergency Medical Service; the data are presented in Table 6 and Table 7.

Table 6: Numbers of patients with traumas (based on an emergency call).

Age (years)	Patient status		
	Not vital danger	Vital danger	Resuscitation
	boys/girls	boys/girls	boys+ girls
3–6 y.	34/18	10/18	≤3
7–11 y.	59/36	32/20	≤3
12–15 y.	59/47	44/26	≤3
15–19 y.	74/46	45/24	≤3
In total	226/147	131/88	≤3

Note: Includes all persons alive contacted in primary rides (flights). For exceptional cases of resuscitation (0-3 cases), the number "≤3" is given. Source: Authors.

Table 7: Numbers of patients with acute conditions of chronic diseases (based on an emergency call).

Age (years)	Patient status		
	Not vital danger	Vital danger	Resuscitation
	boys/girls	boys/girls	boys+ girls
3–6 y.	19/31	32/37	≤3
7–11 y.	51/42	20/27	≤3
12–15 y.	55/97	30/51	≤3
15–19 y.	79/155	55/92	≤3
In total	204/325	137/207	≤3

Note: Includes all persons alive contacted in primary rides (flights). For exceptional cases of resuscitation (0-3 cases), the number "≤3" is given. Source: Authors.

3.6.1 Cause of action – based on an emergency call for patients with started/ongoing resuscitation performed by bystanders

The causes are listed from most common to less common. Children 3–6 years old: drowning, polytrauma, intracranial injury, unconsciousness, cardiac arrest; children 7–11 years old: intracranial injury, polytrauma, unconsciousness, cardiac arrest,

drowning; adolescents 12–15 years old: unconsciousness, meningitis, cardiac arrest, acute intoxication, sepsis; adolescents 15–19 years old: polytrauma, intracranial injury, cardiac arrest, unconsciousness.

3.6.2 Cause of action – based on an emergency call for patients with life-threatening conditions

The causes are listed from most common to less common. Children 3–6 years old: fever (unspecified), unspecified head injury, shortness of breath (dyspnoea), febrile convulsions, acute obstructive laryngitis (croup), other and unspecified abdominal pain, penetrating head injury (partially unspecified), nausea and vomiting, concussion, epilepsy (unspecified); children 7–11 years old: head injury (unspecified), fever (unspecified), other and unspecified abdominal pain, concussion, syncope and collapse, nausea and vomiting, epilepsy (unspecified), penetrating head injury (partially unspecified), allergies (unspecified), shortness of breath (dyspnoea); adolescents 12–15 years old: syncope and collapse, other and unspecified abdominal pain, unspecified head injury, concussion, epilepsy (unspecified), knee contusion, disorders caused by alcohol – acute intoxication, fracture of forearm (partially unspecified), fever (unspecified), hyperventilation; adolescents 15–19 years old: unspecified head injury, syncope and collapse, other and unspecified abdominal pain, epilepsy (unspecified), disorders caused by alcohol – acute intoxication, concussion, knee contusion, fever (unspecified), psychotic disorders (unspecified).

3.6.3 Cause of action – based on an emergency call for patients with non-life-threatening conditions

The causes are listed from most common to less common. Children 3–6 years old: fever (unspecified), unspecified head injury, penetrating head injury (partially unspecified), allergies (unspecified), medical examination and observation after a traffic accident, nausea and vomiting, other and unspecified abdominal pain, shortness of breath (dyspnoea), nosebleed/epistaxis; children 7–11 years old: unspecified head injury, fever (unspecified), nausea and vomiting, medical examination and observation after a traffic accident, other and unspecified abdominal pain, allergies (unspecified), penetrating head injury (partially unspecified), knee contusion, syncope and collapse, hyperventilation; adolescents 12–15 years old: syncope and collapse, hyperventilation, unspecified head injury, disorders caused by alcohol – acute intoxication, fever (unspecified), allergies (unspecified), nausea and fatigue, other and unspecified abdominal pain, shortness of breath (dyspnoea), psychotic disorders (unspecified); adolescents 15–19 years old: syncope and collapse, disorders caused by alcohol – acute intoxication, unspecified head injury, medical examination and observation after a traffic accident, hyperventilation, other and unspecified abdominal pain, nausea and vomiting, knee contusion, epilepsy (unspecified), wrist and hand injuries (unspecified).

4 Discussion

4.1 Level of knowledge of basic first aid

The level of knowledge of basic first aid before our first-aid course was insufficient (the mean value was 66%). The highest scores were calculated for fall from a height (96%), suffocation (94%), fever (91%), headache (90%), and psychological support (90%). On the other hand, the lowest scores were calculated for the CPR item (an alarming 16%), a knocked-out tooth (18%), shortness of breath (33%), nosebleed (41%), and panic attack (42%). The differences in knowledge of first aid before and after our first-aid course were statistically significant when assessed for all students in the overall results ($p \leq 0.05$), as well as for all subgroups in individual items ($p \leq 0.05$ in all comparisons). The level of knowledge of basic first aid after our first-aid course was sufficient (the mean value was 81%). However, as teachers (Hrušková et al., 2022) expressed their wish, the first-aid course should be repeated every year or every two years (71%), predominantly using simulations (93%).

4.2 Chronic diseases in current/former classmates or loved ones

While traumas can happen in every class, students and teachers usually have the opportunity to share information about chronic diseases in children and adolescents attending school and the same goes for loved ones. All our students are/were close with at least one chronic disease in current/former classmates or loved ones. Students reported in the questionnaire that they are/were close with the following selected chronic diseases (the frequency of affirmative answers of all students): food allergy (70%), diabetes mellitus (58%), nosebleed/epistaxis (55%), allergy to insect bites (50%), asthma (47%), and epilepsy (31%). Likewise, teachers (Hrušková et al., 2022) reported the most frequently food allergies (dairy products, chocolate, gluten, and citrus). In recent decades the trend of a higher incidence of allergies and food intolerance has been stated across the whole Czech Republic (Fuchs, 2011; UZIS, 2021). Also chronic rhinitis (with epistaxes), epilepsy, bronchial asthma, diabetes mellitus, and allergy to insect bites were expressed by teachers (Hrušková et al., 2022).

4.3 Content of the first-aid course and statistics of the teachers and the Emergency Medical Service

Pre-primary, primary, and secondary-school teachers (Hrušková et al., 2022) mentioned subsequent changes in the health status of the child (listed from the most frequent to rare in the questionnaires): nausea, headaches, elevated temperatures or fevers, abrasions and lacerations, fractures caused by the child falling, complications of allergies (pollen, mites, food, insect bites) and food intolerance, removing a tick, asthma, convulsive state/epilepsy, hypoglycaemia/diabetes mellitus, concussion, nosebleeds, the child getting the wind knocked out of him/her, suffocation, a knocked-out tooth, scalding, anaphylaxis, burns and scalds, panic attack, a foreign body being embedded in the wound, or swallowing an object. In addition, the statistics of the South Bohemian Emergency Medical Service mentioned unconsciousness, intracranial injury, cardiac arrest, and further meningitis, sepsis, drowning, intoxication, or unspecified psychotic/behavioral disorders. First aid in all these conditions can and ought to be explained during a first-aid course for teachers. It is necessary to appeal to schools' administrations in order to prevent any tragedies and to ensure first-aid training for all teachers. Not only physical-education teachers but any teacher should know first aid. It is necessary to understand that the health status of any pupil can suddenly change during any lesson. Should it be necessary to add other reasons for why knowledge of first aid is necessary, all relevant medical statistics on Czech children and adolescents are provided by UZIS (2022).

4.4 Teachers or future teachers educated in basic first aid

Ninety-eight percent of the schoolteachers agreed with including first aid training in schools and as part of university degree programs (Abelairas-Gómez et al., 2021). Our first-aid course is a mandatory part of the curriculum for future teachers at the Faculty of Education. Students (future teachers at the pre-primary, primary, and secondary-school levels) are trained according to the current recommendations of the European Resuscitation Council for teaching first aid (Greif et al., 2021). Students learn theory and practical skills, including simulations (safety, calling emergency, control of consciousness and breathing, resuscitation, arrest of massive bleeding, traumas and non-traumas, and others).

Students of Faculty of Education with first-aid training could serve as tutors at educational activities or camps, consequently they could provide first aid more frequently. Therefore, it is understandable that our students with previous first-aid training reported providing first aid more frequently than those who have not passed any first-aid course. In addition, the expected outcome of any basic first aid course is that students are more safety-conscious and more willing to provide first aid, because they have learned and practiced the procedures (Kuba et al.,

2019) and also students with any first-aid course should be less afraid to help someone (Kuba & Havlíková, 2023).

Except for teachers of children aged 7–15 years, the teachers (Hrušková et al., 2022) expressed a considerable degree of uncertainty in their ability to provide appropriate first aid (e.g. 56% of secondary-school teachers teaching for 21 years or more, 36% of pre-primary teachers teaching for 21 years or more). Similarly e.g. 50% of Flemish teachers felt that they lacked knowledge of first aid (Mpotos et al., 2013). It can be recommended that a higher frequency and targeting of first-aid courses be provided to everyone (e.g. passing a first-aid course including possible health conditions using simulations once every two years). Qualified lecturers (a) in terms of first-aid topics, (b) acquiring the necessary educational and psychological skills and principles, (c) didactic competences, and (d) necessary equipment (Kuba & Havlíková, 2023) are essential. In any event, teachers (Hrušková et al., 2022) expressed their wish to take a first-aid course once every year or every two years (71%), predominantly using simulations (93%).

4.5 Basic first aid training for pupils

Teaching basic first aid should be an integral part of the Framework Education Programme for Basic Education (FEP BE, 2008). After an update ("minor revision"; FEP BE, 2021) only isolated parts of basic first aid remained in the mandatory education at the lower secondary-school level. Within the mandatory subject Physical Education, first aid in physical education and sports is required; within the mandatory subject Chemistry, first aid in case of skin contact with acid or hydroxide is required; and within the mandatory subject Biology, first aid for mushroom poisoning is required. On the contrary, providing adequate first aid if necessary is required in the non-mandatory subject Health Education. Another update ("major revision"; FEP BE, 2023) is currently being worked out, which should hopefully lead to the re-inclusion of all basic first aid for pupils.

4.6 Teacher or future teacher as a first-aid instructor

According to a British study (Cooper, 2012), 89–99% of the pupils enjoyed first-aid training, and 98% of the parents believed it was important for their children to learn first aid. Future teachers of Physical Education, Human Biology, etc. can teach first aid very competently (Jimenez-Fábrega et al., 2009; Bohn et al., 2012) but need more support in their university curricula in Norway (Bakke et al., 2017), just as in the Czech Republic (Kuba & Havlíková, 2023).

Motivation to teach first aid could be reduced by the unclear range of topics and procedures of basic first aid for pupils (Bakke et al., 2017), lack of time for the inclusion of first-aid teaching in education (Campbell, 2012) as a consequence of an extensive curriculum of subjects, or lack of funds for first-aid instructors and equipment (De Buck et al., 2015) – especially a sufficient number of resuscitation manikins (Kuba & Havlíková, 2023). Additionally, our previous research (Hrušková et al., 2022) has shown that some teachers (3% of all teachers) stated None with regard to a first-aid course. According to Czech law and from the point of view of pupils and their parents, it seems impossible for children and adolescents to be under the charge of someone who has not passed any first-aid course. A lack of knowledge of first aid can have serious consequences for a particular teacher.

An acute condition does not have to be lethal if bystanders can take the right steps immediately, however. Bystanders are the basis for the chain of survival (a series of actions that, properly executed, reduce mortality). Trained pupils could help themselves, and the people around them, not only after the first-aid course but also in adulthood. They could be bystanders willing and able to help. When first-aid training is not mandatory, uptake in schools is low, even if teachers are convinced of its importance (Campbell, 2012).

5 Conclusion

Students filled out a questionnaire that contained first-aid test questions as well as questions about providing first aid, and contact with current/former schoolmates or loved ones with chronic disease. Students are trained according to the current recommendations of the European Resuscitation Council for teaching first aid (Greif et al., 2021), statistics of Emergency Medical Service, and responses from teachers (Hrušková et al., 2022). Through the questionnaire survey (a) significant differences were found in the mean values of knowledge of first aid in sum between all subgroups of students ($p \leq 0.05$), (b) in the level of knowledge of first aid for cardiopulmonary resuscitation (CPR), traumas, and acute conditions of chronic diseases ($p \leq 0.05$), and (c) in the level of knowledge of each first-aid item individually ($p \leq 0.05$).

In general, completing our first-aid course is essential for all our students ($p \leq 0.05$), even for those who have already completed some previous first-aid course.

The authors thank the students, the teachers and the Emergency Medical Service for their helpfulness and willingness to participate.

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EMERGENCE, DEVELOPMENT AND SUSTAINABILITY OF INNOVATIVE ENTERPRISES

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Abstract: Currently, innovations introduced in companies that are exposed to a complex business environment are a hot topic of discussion. Their growth and sustainability are intrinsically linked to innovation processes. In order for enterprises to move forward, this very issue with its emphasis on strategic sustainability in such enterprises represents, in our view, a research gap that needs to be continuously explored in greater depth. In the present paper, we focus on Slovak enterprises that are based on the development of new products in Slovakia and which are also part of a stagnant innovation environment. Attention is drawn to selected aspects influencing innovation in enterprises, which should be perceived by companies not as a burden, but as an intrinsic need for their further development and their sustainability in the long term.

Keywords: innovation, innovative enterprise, growth strategy, strategic sustainability.

Introduction

Innovation is a key tool for Slovak companies to achieve competitive advantage, diversify the economy and develop sustainably in a period of rapid technological change. Enterprises that introduce innovations should be unique (not just adopted from other countries) so that the future position of Slovak producers and suppliers in the value chain remains competitive and sustainable at European level. Innovation should be perceived as a strategic priority for enterprises that can help strengthen their innovation potential and competitiveness in the market. Slovakia is a country that has the prerequisites to become a strong innovator if it invests finance in research, development and innovation, in retaining and attracting talent, and, moreover, it will reward those who will perform well and will pull Slovakia up to a higher rung of innovators in the 21st century, not only at European level, but also at global level in the coming period.

1 Theoretical approaches to innovation

Innovation is becoming an increasingly important determinant of business success in the era of globalization and digitalization. Renewing the economic catching-up of EU countries requires a transition to a new economic model based on innovation. This transition requires improving the business environment by reducing red tape, digitizing public administration and improving law enforcement. Continued reforms of the education system, research funding and organization, as well as increased R&D spending are essential (Národná banka Slovenska, 2022).

The Research and Innovation Strategy for Smart Specialization of the Slovak Republic 2021-2027 also refers to a system of policies and measures in the field of research, innovation and human resources that will support the stimulation of the structural change of the Slovak economy towards growth based on increasing research and innovation capacity and excellence in the segments with the highest competitive ability (Ministerstvo investícií, regionálneho rozvoja a informatizácie Slovenskej Republiky, 2021).

In 2022, globally, four of the five companies with the largest R&D expenditures were located in the Americas. These are companies such as Amazon (\$42.7 billion), Alphabet (\$27.6 billion), Microsoft (\$19.3 billion) and Apple (\$18.8 billion).

Innovation makes businesses grow, become more efficient, more competitive and enables them to create new markets. The Europe

2020 strategy also saw innovation as a driver of our future growth. Particularly in the current dynamic period, the need for innovation is even greater, as highlighted by the current pandemic, during which businesses have been forced to react quickly and flexibly to changes in the market. Despite the fact that more and more entrepreneurs are becoming aware of the importance of innovation, small and medium-sized enterprises are often left in the wake of larger, often multinational, companies when it comes to implementing innovation. Slovakia is Europe's innovation laggard and will not progress without innovation. In 2022, it ranked 46th in the list of the 50 most innovative countries in the world. Russia and Vietnam were given the same ranking as Slovakia. There are only two countries in this top 50 ranking that invest less in innovation than Slovakia, namely Romania and Chile (Národná banka Slovenska, 2022), which we view negatively.

The main source of economic underdevelopment of the Slovak Republic is low productivity caused by a low share of value added in total output due to a low level of product or technological innovation, as well as the declining quality of human capital. Employers also point to the declining quality of secondary and university graduates (Ministerstvo investícií, regionálneho rozvoja a informatizácie Slovenskej Republiky, 2021).

Insufficient investment in education and research and insufficient development of the capital market are two factors that indicate that it is crucial for Slovakia to invest in quality education, science and research and at the same time develop its capital market. Without these innovations and measures, the country could stagnate in the middle-income trap and fail to achieve sustained economic growth (Ižip, 2023).

The need to introduce innovations is therefore inevitable for Slovak SMEs in terms of adaptation. According to the European Commission's assessment, skills and innovation are one of the areas in which Slovak SMEs lag furthest behind (SBA, 2020; European Commission, 2009). Their economic prosperity is a dynamic process and requires a dynamic solution.

As a strategic issue, innovation in the enterprise is an important source of competitiveness and its essence is based on the creation, adoption and implementation of new ideas, processes, products or services (Adamcová, 2020). They contribute to the efficiency of overall work, to reducing costs in the enterprise or to saving money and provide enterprises with higher growth, increase efficiency, competitiveness and enable enterprises to create new markets. In spite of these unquestionable aspects, Slovakia has long ranked among the EU's below-average countries in terms of innovation uptake. All European countries, with the exception of Romania, are in a better economic situation than Slovakia. This situation is causing an outflow of foreign investment and skilled people from Slovakia to other countries. An example for Slovakia is Switzerland, which has become the most innovative country in the world for the twelfth time in a row, followed by the United States and Sweden.

Innovations have the unique ability to turn less into more. New technologies increase the efficiency of various activities, thus contributing to faster production processes and improved quality of the resulting products. Innovation opens the door to new markets and opportunities for Slovak companies. Slovak companies that develop innovative solutions in the field of renewable energy can become leaders in this growing sector and contribute to the sustainable growth of Slovakia.

Despite the fact that Slovakia is already supporting innovative enterprises and striving to create an innovation-friendly environment, the innovation performance of Slovakia still lags behind other (mainly Nordic and Western) EU countries, which can be ranked among the global innovation leaders.

In 2020, the EU Member States were divided into 4 groups of countries – innovation leaders (Denmark, Finland, the Netherlands and Sweden), strong innovators (Austria, Belgium, Estonia, France, Germany, Ireland, Luxembourg and the UK), average innovators (Croatia, Cyprus, the Czech Republic, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, Slovenia and Spain), moderate innovators (Bulgaria and Romania). It is clear that Slovakia is not performing above average in innovation performance. It was only among the average innovators like the Czech Republic, Hungary, Poland, etc. (SBAdmin, 2023).

Innovative businesses (especially SMEs) need to develop continuously to be sustainable in the long term and to ensure their success in the marketplace in the face of complexity and turbulence. They need to clearly define their uniqueness and sustainable competitive advantage, which becomes the core of their business strategy. Improving business performance requires successful innovation and invention.

An invention is an idea, an invention, a new technical solution, a tangible output of scientific research, but only some inventions become innovations (Csank, Jovanović & Vozáb, 2016).

The innovation process draws on recent trends such as the role of global value chains; the emergence of new information technologies and the way they influence new business models; the growing importance of knowledge capital; and advances in understanding innovation processes and their impact on the economy (OECD, 2018).

We have few innovative companies in Slovakia. These are new technologies-based firms (NTBFs) with high innovation and a regular stream of small innovations for which technology is dominant. Similarly, scale-ups, i.e., former start-ups that have been in existence or in business for at least 3 years, have a reason and a premise for rapid growth, or are in a phase of rapid growth, or have gone through a period of rapid and significant upswing, have a technology base, are unusual, innovative, but have a realistic business idea, and are bringing highly sophisticated innovative products and services to the marketplace. Promoting the introduction of technological innovation is a tool for companies to recover from the crisis, increase labor productivity and the quality of production, and bring about sustainable economic growth.

Innovation can open the door to creating new markets and opportunities for Slovak companies that develop innovative solutions. By developing them, they can become leaders in the sector and thus ensure Slovakia's strategic sustainability.

These enterprises take on an important macroeconomic role, are agents of socio-economic progress, contribute to sustainable economic growth, are creators of skilled jobs, and develop the market by establishing new industries. Enterprises with a regular stream of small innovations are also value creators for the national economy.

Four types of innovation were used in the last Oslo Manual – product, process, organization and marketing innovation. In the current period, the Oslo Manual distinguishes two types of innovation - product innovation and business process innovation. It defines innovation as a new or improved product or process (or combination thereof) that is significantly different from previous products or processes and has been made available to potential users (product innovation) or has been put into use by the entity (process innovation). Anything that develops innovations – enterprises, households or associations – is considered to be a unit (OECD, 2018).

In addition to product and process innovation, marketing and organizational innovation are also defined. Marketing innovation is defined as the implementation of a new marketing method involving significant changes in product design or packaging, product positioning, promotion or product pricing (OECD/Eurostat, 2005). Organizational innovation is the

implementation of a new way of organizing a company's business practices, workplace organization or external relations. It focuses on changes in the workplace to increase productivity, but also to increase workplace satisfaction, reduce administrative or transaction costs (OECD/Eurostat, 2005). Organizational innovation in the enterprise includes new business practices (new ways of managing the supply chain, quality management), new methods of organizing human resources (training, centralization, decentralization) and new methods of organizing external relations with enterprises and other institutions (Český statistický úřad, 2016).

Design is also coming to the fore, playing a key role in the development and implementation of innovations. Although a definition of design has not yet been established, according to the "Frascati Manual", design can be described as a potential multifaceted innovation activity focusing on planning and design processes, technical specifications and other user and functional characteristics for new products and processes (OECD Publishing, 2015). Eurostat defines eco-innovation. It is any form of innovation aimed at making significant and demonstrable progress towards the Sustainable Development Goal. This can be achieved either by reducing the environmental impact or by achieving a more efficient and responsible use of resources (European Commission, 2022).

In recent years, according to the Slovak Business Agency (SBA), various surveys have shown a downward trend in the share of innovating SMEs in the total number of SMEs, indicating that the interest in innovation among Slovak SMEs is not growing, but in spite of this, more than 94% of entrepreneurs consider it necessary to innovate, and at the same time, more than half of innovating enterprises (53.8%) stated that they innovate on a regular basis (Adamcová, 2020).

According to data from the SBA, more than half of innovative companies are engaged in innovation of products, services, as well as processes and marketing. The main sources of innovation incentives for businesses are external factors, but they also receive incentives from their owners or managers. Less frequently, innovation ideas emerge from employees, or innovation is carried out spontaneously. Enterprises active in innovation, in many cases rely on their own resources, sometimes collaborating with private enterprises.

Innovation processes in companies do not need to be managed in isolation, as external partnerships also play an important role and can be beneficial (Dahlander & Gann, 2010; Love, Roper & Vahter, 2013; Bouncken, Fredrich & Gudergan, 2022; Hutter, Gfrerer & Lindner, 2020). The development of innovative enterprises can improve the standard of living of the Slovak population.

High demands are placed on managers and they are forced to reflect with other employees on how to innovate processes to make them sustainable at regional to local level, to create an innovation system to increase the skills of start-up entrepreneurs in the areas of new technologies, innovative products, services, processes or social innovation. Innovation is a priority for every business, affecting their future, whether from the perspective of owners or employees. Every enterprise has a certain potential of innovation capacity, which can be achieved by a coherent package of strategies, creative employees and many innovation projects, innovative ways of inspiration, training, but also by supporting start-ups in their region. Exploring the reasons for the low proportion of businesses innovating, the SBA's May-June 2020 survey found that entrepreneurs considered lack of finance (71.5%), lack of adequate government/EU support (38.2%), and lack of skilled labor (25.7%) to be the biggest barriers to innovation adoption. In the context of the COVID-19 pandemic, up to 50.0% of respondents reported that they had to cancel or postpone planned innovation activities (Adamcová, 2020).

Innovative businesses should also rely on a sustainable business strategy, which is the overarching, main strategy of the business. This strategy is based on the principles of the concept of sustainable development. The corporate social responsibility

strategy should also be seen as an integral part of the corporate strategy, i.e., the sustainable development strategy, which is followed by sustainable business unit strategies and then sustainable functional strategies (Hrdinová et al., 2011). A key feature of strategy is the provision of value over and above normal conduct (Zimmermann, 2011) and addressing the issue of how the enterprise will compete in its business or in one of its market segments. The point of business strategy is to gain a competitive advantage over rivals (Slávik, 2013).

Current studies identify sustainable competitive advantage as a major option for business growth and viability. The task of the management of a company is to develop a strategy for its business in such a way that it gains a competitive advantage and is able to transfer innovation and continuous further development. Based on the information obtained in the research on innovative enterprises, we can conclude that 5 factors from the business environment are important in their emergence and sustainability through competitive advantage. They are:

1. Innovation – it is the ability to innovate; it is a key factor in creating a sustainable competitive advantage; businesses exposed to a turbulent business environment are able to continuously develop new products, processes or services and thus tend to be more successful in the marketplace.
2. Investment – refers not only to the streamlining and improvement of processes, but also to modernization, technology and the development of human resources, which become a strong manifestation of the competitive advantages of innovative enterprises; they improve the efficiency and quality of production; innovative enterprises offer lower prices for their products and services compared to their competitors.
3. Human resources – only highly skilled and motivated employees are an invaluable source of competitive advantage; businesses that care about their employees and invest in their development tend to perform better; the human resource factor affects the prosperity of the business.
4. Natural resources (wealth) – in some sectors, natural resources have a major impact on competitive advantage; their efficient use can help businesses achieve a sustainable competitive advantage.
5. Financial resources – financial stability and the availability of financial resources contribute to a company's competitive advantage; companies with easier access to finance often have greater flexibility to invest and grow, which is also evident in their growth strategies.

After the exhaustion of the driving forces, which are production factors (natural and human resources), then investment in Slovakia, especially foreign investment, innovation should be the main force of the country's economic growth at present and in the near future. The whole process of innovation should end with the accumulation of wealth in Slovakia.

The path to competitive advantage, along with the scale of activities, is complex and the enterprise seeks to gain it through three basic strategies. These are cost leadership strategy, differentiation strategy and specialization strategy (Porter, 1994).

Sustainability, however, requires a drastic rethinking and renewal of existing activities, competencies, corporate culture and stakeholder relationships (Bertassini et al., 2021; Gandolfo & Lupi, 2021; Hofmann & Jaeger-Erben, 2020; Kaipainen, Aarikka-Stenroos & Ranta, 2020). Becoming sustainable involves a continuous process of organizational innovation and cross-cutting development (Fowler & Hope, 2007) that is aligned with the economic, environmental and social needs of current and future generations. The prerequisites for corporate sustainability and the journey from idea (invention) through overcoming vulnerabilities to success depend on a well-chosen business strategy.

The concept of strategy often emphasizes how the entrepreneur seeks to achieve a goal and therefore uses a process approach to

strategy (Von Gelderen, Frese & Thurik, 2000). The fact is that strategic development for sustainability is a complex process and fundamentally changes the way established businesses do business (Engert, Rauter & Baumgartner, 2016; Gandolfo & Lupi, 2021; Keijzers, 2002). It is strategic development called strategic renewal (Agarwal & Helfat, 2009). Sustainability and circularity change the business logic of incumbent enterprises and require these enterprises to reshape existing business models (Frishammar & Parida, 2019; Gandolfo & Lupi, 2021; Ranta, Keränen & Aarikka-Stenroos, 2020; Rovanto & Bask, 2020).

Renewal for sustainability has been found to require incumbents to improve their business model and value creation (Hofmann & Jaeger-Erben, 2020; Ranta, Keränen & Aarikka-Stenroos, 2020), business and core operations (Albino, Balice & Dangelico, 2009; Shrivastava & Scott, 1992), as well as stakeholder relationships, networks and entrepreneurial ecosystems (Aarikka-Stenroos, Ritala & Thomas, 2021; Kaipainen, Aarikka-Stenroos & Ranta, 2020).

Innovative businesses are a trend, even a megatrend, because they can reach the elite at record speed and build a strong competitive advantage, but even a temporarily created organization, a cluster, used to find a repeatable and scalable business model (Hassin, 2015) is a prerequisite for a viable and sustainable innovative enterprise. Some authors state that from an innovation perspective, the collaboration of large enterprises with start-ups makes them more productive (Park et al., 2022).

It is clear from many research studies that the development of a sustainability strategy is a key practice in successfully updating established business models (Santa-Maria, Vermeulen & Baumgartner, 2021). Business model innovation can include new ways for a company to create value and new fixed offerings (e.g. product or service innovation), new ways for customers to view a company's offerings (position innovation), changes in how a company evaluates its activities (paradigm innovation) and operations (process innovation). Thus, an innovative business model is a new integrated logic for creating and capturing value that may involve a new combination of new and old products or services, market position, processes, and other types of changes (Frankenberger et al., 2013). Much research has not considered how incumbent businesses should renew (innovate) their business strategies to support sustainability. It is about renewing business strategies to support sustainability in line with their changing business models.

Businesses often seek to innovate their processes, products and services in order to achieve revenue growth or to maintain or improve profit margins. Innovation of business processes, products and services is mostly expensive and time consuming. They require significant initial investment in research and development, the purchase of specialized resources, the construction of new plants and equipment or the creation of new business units. However, the return on such investments is uncertain. For this reason, more and more enterprises are looking at innovation of their business model as a lower cost, lower risk alternative or as a complement to process, product and service innovation.

The ability to frequently and successfully innovate the business model can help a business to increase its resilience to changes in the external environment and represents a sustainable competitive advantage (Mitchell & Coles, 2003). An innovative and sustainable business model refers to how a business creates, delivers and captures value, because businesses are human institutions designed to create a new product or service under extremely uncertain conditions (Ries, 2015), which must now also respond to a global environment marked by either pandemics or invasions. The COVID-19 pandemic has most often delayed innovation activities in innovating companies, but it has also created space for a quarter of companies to prepare new innovation activities and has not affected innovation activity in more than 20% of companies.

According to the SBA, enterprises engaged in innovative activities consider the biggest barriers to be those related to the financing of innovative activities and the lack of support from the state/EU. Other barriers appear to be barriers in the personnel area, in cooperation with suppliers and customers, barriers in the area of know-how, competition, or support from the state and the EU are also barriers. Both innovating and non-innovating enterprises would welcome, in order to increase innovation activity in the enterprise, increased awareness of existing forms of state/EU support for innovation, as well as more effective support for innovative enterprises and the organization of more professional events in order to increase the qualification of employees.

Innovative enterprises would also step-up cooperation with research institutions and improve access to the innovation cluster/hub.

Non-innovating enterprises see the biggest innovation barriers in the area of financing innovation activities, but also in the lack of skilled workforce, lack of knowledge/information about innovation activities.

Given the above facts, we conclude that innovation is the key to solving or addressing social and environmental problems, businesses are increasingly embracing the development of sustainable innovations to create shared social and business value (Du, Bstieler & Yalcinkaya, 2022). Innovation achieves the long-term growth and success of a business in a changing business environment (Day & Schoemaker, 2016). Therefore, innovative businesses will need to develop new strategy concepts (Hart, 1995) and ensure their sustainability (D'Angelo, V., & Magnusson, 2021; Denicolai, Zucchella & Magnani, 2021).

Strategic sustainability has gained importance and has become a key issue in business strategies (Engert, Rauter & Baumgartner, 2016; Martin & Rice, 2010). It is therefore important to examine the strategic renewal process of established businesses aimed at achieving strategic sustainability. Emerging innovative enterprises are able to achieve strategic sustainability through key success factors (Saura, Palos-Sanchez & Grilo, 2019; Ceaușu et al., 2017) which are prerequisites for a sustainable enterprise (Ghezzi, 2020; Shepherd & Gruber, 2020; Bortolini et al., 2018; Schwaninger & Scheef, 2016) being viable and sustainable in the long term (Etim, 2020).

Some experts explain that the impact of innovation moves the enterprise forward and in this logic, they openly talk about the positive impacts of innovation strategies that present specific challenges for the enterprise (Dahlander, O'Mahony & Gann, 2014). To be successful and strategically sustainable, innovative enterprises need to have a good business model, an appropriate business strategy and to continuously innovate their processes.

The process of integrating sustainability into business strategy varies from company to company, and is particularly challenging in established companies that are trying to reinvent their business models to achieve sustainability and circularity (Frishammar & Parida, 2019; Rovanto & Bask, 2020; Kaipainen, Aarikka-Stenroos & Ranta, 2020). However, given the difficulty and gradual implementation of strategic renewal, incumbents are often criticized for being slow to act or for deliberately hindering the diffusion of sustainable innovations in order to maintain their strategic position (Smink, Hekkert & Negro, 2015).

We note that innovative enterprises create value for the enterprise through new ideas, concepts and more efficient ways of bringing success, whether in finding an innovative product/service or in a cluster of smaller innovations.

Also, in the National Strategy for Research, Development and Innovation 2030, the aim is to move Slovakia up ten places in the innovation performance ranking, to increase investment in R&D to 2% of GDP, including 1.2% from private sources, and

to attract 25,000 highly qualified people from abroad (Výskumná a inovačná autorita, 2023).

In order for businesses to move forward, this issue, with its emphasis on the strategic sustainability of innovative businesses, represents, in our view, a research gap that needs to be continuously explored in greater depth.

2 Aim and methods

The aim of this paper is to evaluate product/service excellence and identify evidence of product/service excellence in a sample of innovative Slovak enterprises based on the development of new products and services in a complex business environment, and to highlight the enterprise's growth behavior and motivations for growth in the internal business environment. The study sample consisted of SMEs that are part of a stagnant innovation environment. In the studied sample, we highlight selected factors influencing their growth strategies that have been able to defy the environment and tend to offer innovative or more developed services and products.

The object of the study was a sample of 146 small and medium-sized enterprises operating in a domestic environment. The enterprises were poised for rapid growth or were in a phase of rapid growth or had passed through a period of rapid and significant upswing and were currently growing only slowly. These are enterprises with a legal form of business and have carried out business activities in any sector. The study sample of 146 enterprises was obtained through a questionnaire survey and guided interviews with managers in Slovak enterprises in 2022. The questionnaires were processed and evaluated through mathematical and statistical methods in Excel.

3 Research results

The results from the research conducted through descriptive statistics only highlight selected aspects that influence growth strategies in companies.

A scale of 1 to 4 (1-local level, 2-regional level, 3-central European level and 4-European level) was used to assess the product/service excellence of the sample of 146 enterprises surveyed. The local level with completely ordinary products was reached by 85 enterprises, representing 58.20% of the total. This may indicate that the product does not have distinctive parameters that differentiate it from common products on the market. Regional to national excellence was recorded by 44 enterprises (30.13%). This level represents a substantial proportion of businesses that perceive the product or service in terms of regional or national uniqueness, indicating that there are certain characteristics of the product or service that are unique within the area or country. Only 15 enterprises (10.27%) rate the product at the Central European level and consider it attractive even in the near abroad. We note that the product has certain features or benefits that are attractive to customers outside the local area or country. A small number of enterprises (2/1.36%) perceive the product as a European excellence, attractive also to customers in more distant parts of the country. This group of enterprises may be the result of the product having special features or quality that can establish itself in the international market. When evaluating the uniqueness of a product/service, most respondents perceive the product as local and quite ordinary, but there is also interest in products/services at regional, national and even Central European level. It is important to investigate what specific factors or characteristics are important to these businesses when evaluating the excellence of a product or service and whether there are areas where the product or service could become even more attractive.

We scaled the evidence of product/service excellence into absolute evidence and relative/comparative evidence. We found the former in 75 enterprises and the latter in 71 enterprises. Absolute evidence is a key success factor for the sustainability of enterprises. These are customer satisfaction and loyalty, which indicate that a product or service is meeting their expectations.

Recorded profit and revenue growth are important economic indicators for the sustainability and success of businesses. From the research conducted, continuous investment in innovation appears to be a key factor, which is also important for the long-term growth, success and sustainability of businesses. These investments can provide a competitive advantage that becomes core to their business strategy and keep the product or service at the forefront of the industry. Goodwill has a good reputation and a positive perception in the marketplace.

Relative/comparative evidence included awards from competitions, certificates, diplomas, reviews, recommendations from external institutions that can confirm the excellence of the product or service. Customer reviews and recommendations are also a strong indicator of quality. Comparison of the product/service with competitors is an important picture of the product or service in comparison with competitors. They also identify their strengths. Few competitors experience less competitive pressure and more opportunity to gain market share. However, it is important to monitor new entrants in the market and secure a sustainable advantage.

Overall, these are strong indicators suggesting that the products and services in the sample of businesses surveyed are competitive and useful to the end consumer. These aspects need to be continuously examined and the business needs to adapt based on the feedback.

The research results also present externally measurable manifestations of growth. Each of these factors has its own contribution to the growth behavior of a business. These are selected aspects – sales, capacity, new customers, profit, employees, product mix, position, acquisition, investment and others. Sales were recorded in 65 enterprises/44.5%, capacity in 36 enterprises/24.6% which can be an important factor to ensure sufficient ability to meet the growing demand from customers, new customers recorded in 12 enterprises/8.2% can contribute to market expansion and risk diversification. Profitability is an important indicator of the success of a business from an economic point of view. Profit growth may be the result of effective cost management, improved efficiency or innovation. Profit was recorded by 11 enterprises/7.5% of the total number of enterprises surveyed. The need for a larger workforce to support the expansion of the business was noted by employees in 6 enterprises/4.1% and the same number of enterprises 6/4.1% also noted product mix also impacted on the growth strategy of the enterprises. Growth in the number of employees may be a result of need, and growth in product range may mean an expansion of products or services, which may attract new customers. A low number of 2/1.37% of businesses were noted in consolidating their market positions which impacted on their competitiveness. Acquisitions are a strategic step for the growth strategies of businesses. These were recorded in only 1 enterprise/0.6%. Also, only 1 enterprise/0.6% stated that investment is important for future growth and development. The right investments can promote innovation, efficiency and competitiveness. External measurable manifestations of growth were resisted and not identified by 6 enterprises/4.1%, which we do not rate positively.

In a research sample of 146 businesses, we analyzed the various motivations that led to growth in the business. We categorized the data collected from a representative sample of 146 enterprises into several key aspects of motivation.

Misstatement proved to be the most common motivation for growth in 49 companies, accounting for 33.5%. This category included errors or misunderstandings in the growth strategy, which businesses revise or use as a parameter for strategy improvement.

Profit was an important factor motivating growth, which was recorded in 34 companies/23.3%. Profit-motivated enterprises surveyed often looked for opportunities to increase their profit margins and ensure financial sustainability.

51 companies/34.9% underline that ambitions regarding market position and brand recognition are another important motivation for growth. They underline their desire to achieve an industry-leading position, strengthen their brand and fulfil their ambitions.

Demand, although less pronounced, is a motivator for 8 businesses/5.5%. Businesses that are motivated by demand are likely to be market-driven and seek to grow in response to increased demand for their products or services.

Environmental sustainability and environmental friendliness are motivators for growth in 3 cases/2.1%. Businesses are looking for environmentally responsible growth opportunities and want to continuously contribute to their sustainable development from a strategic perspective.

Sales turn out to be the least significant motivation in the sample studied. It is only 1 enterprise, which amounts to 0%. It is possible that these enterprises consider other factors more important for their growth than profit or market position.

The results suggest that firms are motivated by a variety of factors and their growth decisions are influenced by a combination of internal factors and external conditions.

The growth strategies of the enterprises studied were also influenced by material and personnel resources, as well as their competencies. Human resources and their competencies included the skills and abilities of the employees, which were recorded by 80 enterprises, amounting to 54.8%. Machinery and equipment, premises and other physical facilities necessary for their growth were recorded by 23 enterprises, accounting for 15.7%; financial capital (investments, loans, self-financing) was recorded by 18 enterprises surveyed out of the total, accounting for 12.3%. Material necessary for production or service provision was necessary for growth processes in 8 enterprises, representing 5.5%. 4 enterprises/2.7% included factors such as managerial skills, working environment, efforts to minimize costs and other aspects related to their development. 13 enterprises, representing 8.9%, did not identify material and personnel conditions for their growth.

4 Discussion

The results from the research conducted provide insights into the determinants of growth strategies within a sample of 146 companies. Attention was focused on assessing product excellence, identifying motivations for growth, and externally measurable indicators of success. In the area of product uniqueness evaluation, we observed that the majority of enterprises (58.20%) perceive their products to be locally differentiated, while only a small proportion (1.36%) perceive them to be of European uniqueness. An important finding is that evidence of absolute excellence in 75 enterprises and relative/comparative excellence in 71 enterprises emerge as key success factors for enterprises. Customer satisfaction, loyalty and profit growth are indicators that are indicative of the sustainability of the business in the long run. Investment in innovation is seen as another key factor that can provide a competitive advantage and keep the product/service at the forefront of the industry. Considering the motivations for growth, we have identified various factors. Incorrect strategizing, profit-seeking and ambition for market position were among the most common motivations. These findings highlight the need for dynamic and adaptive growth strategies that reflect the complex influences of the business environment in a web of complexity and turbulence. Externally measurable manifestations of growth, such as sales, capacity, new customers and profit, reveal multiple facets of success. Most businesses identify sales (44.5%) and capacity (24.6%) as key drivers of growth. This suggests that ensuring sufficient capacity and increasing sales are priorities for many businesses in the sample. Human and material resources point to a major influence on growth strategies. Employee capabilities and skills, along with material equipment, finance were identified as critical factors for promoting growth. This highlights the need for effective human

resource management and optimal use of available material resources.

The focus on innovation and their growth strategies should be seen by businesses not as a burden, but as an intrinsic need for their further development.

5 Conclusion

In a complex business environment characterized by a high degree of openness, companies are forced to innovate, not only from the perspective of competitiveness, but also for their existence. Slovak enterprises often innovate on their own and are aware of the importance of innovation, with the main drivers being not only internal but also external influences. However, innovation is very risky and very costly, and its outcome is uncertain. For this reason, the sustainable development of innovative enterprises requires a steady flow and overproduction of creative ideas (invention and innovation). The research conducted on the determinants of growth strategies in a sample of 146 enterprises reveals important factors that influence the success of enterprises.

It is obvious that the favorable results of enterprises are conditioned by quality ideas/inventions; quality implementation of the invention - innovation; quality and successful commercialization of the innovation, when the innovative idea or concept becomes a real product or service and will have value for customers, bring profit to the enterprise or expand market share; quality repetition of the whole process at an ever higher level, as the process spirals upwards. In spite of the above, the whole process, or the result of the process, in spite of the best efforts and the highest quality, is never absolutely perfect or world-beating, and therefore needs to be continuously examined.

In conclusion, we believe that an innovative environment integrated into the international context will give us the courage to face the toughest challenges of the 21st century and Slovakia will rank among the strong innovators.

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Primary Paper Section: A**Secondary Paper Section: AE, AH**

EFFECTS OF STAY ABROAD EXPERIENCES ON GLOBAL BUSINESS LITERACY: A CASE OF CZECH AND SLOVAK UNIVERSITY STUDENTS

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The paper presents partial results of the project KEGA No. 026EU-4/2021 "Development of Global Business Literacy of Students of Economics and Management" in the frame of the granting program of the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic and Slovak Academy of Sciences.

Abstract: Global business literacy is generally considered one of the key competencies important for functioning in today's interconnected global business world. Despite some studies investigating its determinants carried out worldwide, findings related to Central Europe are rather scarce. The aim of this paper is to identify the effects especially of stay abroad experiences, but also other related factors on cultivation of global business literacy of university students. For this purpose, a total of 255 business students from the Czech Republic and Slovakia filled out the online questionnaire. The results of correlation and regression analysis showed that the most important factor for cultivating global business literacy is the completion of a course related to international business, followed by the intensity of interactions with foreigners. The stay abroad experiences significantly positively affect only the self-efficacy dimension of global business literacy. Overall, it appears that global business literacy can be well developed also through internalization activities at home.

Keywords: global business literacy, stay abroad, interaction with foreigners, students

1 Introduction

Today's global and interconnected world requires young people, especially those who aspire to work in the global business world, to be globally literate. Global literacy can be understood as a key literacy that connects global knowledge with awareness and ability to solve global issues (Cakmak et al., 2017), which in the business context, can be defined as global business literacy (hereinafter also "GBL"). Higher educational institutions, in an effort to prepare their students well for operating in a global business world, started to internationalize their environment several decades ago. In the European context, especially the Erasmus mobility program launched in 1987, fostered international mobilities of students and teachers. The new participating countries, including the Czech Republic and Slovakia, also intensively used the benefits of the program (Rodríguez González et al., 2011). In connection with these two countries, Breznik and Skrbinjek (2020) concluded that the Czech Republic should be seen as a good sender of student mobility, and Slovakia appears more like a peripheral country, as student mobility is mainly concentrated in neighboring countries. Thus, both of the countries have actively participated in the Erasmus program, although each in different way.

The effects of study abroad programs on the development of global literacy or more broadly defined global competence have widely been studied in the empirical literature. However, the majority of studies have been carried out in the countries in the north America, western Europe or China. Moreover, the authors usually distinguish between short-term and long-term study abroad programs (e.g. Geyer, 2017; Le et al., 2018), however, the distinguishing criterion in terms of the length of experience is not unified. The present study contributes to the existing literature by analyzing the effects of not only short-term and long-term study abroad programs, but also other very short-term stay abroad experiences, such as short visits, on global business literacy of business students. In addition, the research itself is carried out in the Czech and Slovak environment, which is relatively neglected in the literature so far.

The aim of the study is to investigate the effects of stay abroad experiences as well as other factors on global business literacy of university students, on a basis of correlation and regression analysis. The rest of the paper is organized as follows: The

literature review brings overview of studies that investigated effects of various study abroad programs on global knowledge, skills and attitudes of university students. It is followed by description of methodology used within own research and subsequent presentation of the achieved results. The results are then discussed, leading to the formulation of implications for internalization activities as well as for the future research agenda. Conclusion briefly summarizes the findings.

2 Literature Review

Studies looking at the effects of study abroad programs on global competencies usually distinguish between short-term and long-term study abroad programs, but the time frame of this distinction appears to be relative. Some authors point out to the fact that for comprehensive development of global competence a stay abroad in substantial duration is required. Berg et al. (2009), mention an optimal time frame spent by students abroad in a range of about 13 to 18 weeks to develop intercultural. An even longer stay abroad of at least half a year is considered by Behrnd and Porzelt (2012) to be necessary for the significant development of students' strategic intercultural competence. In a similar duration of one semester, Petersdotter et al. (2017) consider international academic mobility to be significant for the development of students' perceived self-efficacy. At the same time, it was found that the number of social contacts per week mediates the development of higher self-efficacy abroad. These findings were basically confirmed by the qualitative study conducted by Maharaja (2018) in the context of American students studying one semester abroad in different countries. The participants' personal essays about their life experiences documented that they gained a better understanding of their own culture and the culture of other countries, increased their level of global thinking, self-confidence, assertiveness, self-awareness, patience, adaptability and flexibility.

On the other hand, there were shown significant effects of shorter study/ stay abroad programs too. Wolff and Borzikowsky (2018) demonstrated a significant increase in the global intercultural competence of German students after three months spent abroad, with the largest increase recorded in the cultural identity reflection, which shows an intense and constant reflection of one's own cultural character. Schenker (2019) evaluated the effects of eight-week international summer program (conducted in the U.S. and Germany) and showed that students reported statistically significant increase in the majority of global competence dimensions, especially attentiveness to diversity, historical perspective, and open-mindedness but also statistically significant decline in one area, namely global awareness. A study by Nguyen (2017) proved significant influence of various short-term study abroad programs ranging from two to five weeks, on the U.S. students' self-perceived intercultural competence. Similarly, Reynolds-Case (2013) highlighted the development of students' cultural and pragmatic competence manifested through a regional linguistic feature after completion of a four-week study abroad program. Gaia (2015) also concluded that even a three-week study abroad experience increases participants' cultural understanding and global perspective. Analysis conducted by Gil and Reyes (2020) showed that Mexican business students who participated in a very short one-week international trip to New York developed their global mindset together with professional aspirations and networking skills.

However, many authors in regard with short-term programs concluded that they may not be sufficient for the development of all aspects of global competence or literacy. Thus, they need to be supplemented by longer stay abroad or other activities related to internalization at home. As for the latter, their attention is mainly focused on domestic students, who have been rather overlooked in intercultural research, even though they are much

more numerous compared to internationally mobile students (Jon, 2013; Soria and Troisi, 2014).

Some authors showed the impact of well-designed courses related to international business (Schworm et al., 2017) or cross-cultural management (Eisenberg et al., 2013) to the development of students' global literacy, cultural intelligence or even career success. In addition, Fakhredin et al. (2021) suggested that the implementation of specific supplementary teaching techniques, such as experiential and blended learning, which can replace international exposure, can be beneficial for the development of students' cultural intelligence. The examples in this regard can be collaborative online international learning experiences (Garcia et al., 2023), working in international virtual project teams (Rauer et al., 2021), or incorporation of multiple intelligences in online international managerial courses (Pathak, 2018).

Overall it seems that stay abroad experiences are beneficial for the development of global literacy, however their effects differ mainly depending on the length and intensity of their duration. In addition, to increase the range of students involved in internalization activities, many actions described in the relevant literature can be taken as part of internalization at home efforts. As concluded by Wickline et al. (2020), study abroad is not the only one way to increase students' intercultural competence.

3 Methodology

The aim of the study is to identify the effects of stay abroad experiences and other factors on cultivation of global business literacy of university students. For this purpose, the online questionnaire was filled out electronically via MS Forms platform by university students in two countries, namely Czechia and Slovakia, during the last week of the summer term of academic year 2022/2023. In Czechia, a total of 71 business students from Masaryk university in Brno and Prague University of Economics and Business participated in the study. In Slovakia, a total of 184 business students from University of Economics in Bratislava, Faculty of Business Economics seated in Košice participated in the study. Since our previous study (i.e. Bobenič Hintošová, 2023) showed almost no significant differences in the level of global business literacy between these groups of Czech and Slovak students, our total sample consisting of 255 students can be considered culturally homogeneous. It can also be justified by the fact that 28% of the students in the Czech sample are students from Slovakia.

For the purpose of this study, the global business literacy was assessed through the instrument developed by Arevalo et al. (2012), within which five dimensions of global business literacy were covered, namely: *Relationship development* (6 items) is related to the ability to develop and maintain relationships with foreigners. *Self-awareness* (7 items) reflects the perceived knowledge about the own culture and its impact on individual's behavior in an unfamiliar environment. *Self-efficacy* (8 items) expresses self-confidence of a person to deal with life's challenges and specially to adapt to a life and work abroad. *Technical competence* (9 items) is considered as a perceived knowledge of international business and related issues. Finally, *willingness to learn* (8 items) reflects the effort to acquire additional knowledge regarding geography, history, economy of other countries and their cultures. Thus, the main part of the questionnaire consisted of 38 items/statements, while the degree of agreement/disagreement with them was expressed by the respondents on a 7-point Likert scale. To reduce potential response bias, some items were worded negatively and responses were subsequently reverse coded. In general, the higher the score achieved, the higher the global business literacy.

In addition, the questionnaire also contained some background information, which was considered as potential factors determining the level of global business literacy. Within this study we focus on the following factors: Since our main interest is to evaluate the effect of the experiences of living or studying abroad, we asked the respondents whether they had traveled or lived outside their home country and how long this experience

lasted. This factor we labelled as *stay abroad* and the responses were assigned by points depending on the length and intensity of this experience, ranging from 1 (no stay abroad experience) to 6 (currently living and studying abroad). We then considered whether respondents had taken a college class (course) related to international studies or international business (*IB course*), with possible responses – no (1 point); yes, at my home university (2 points); yes, outside my home university (3 points). Another factor taken into account was the intensity of interactions with people from countries other than one's own country (*interactions*), which responses ranged from 1 (rarely) to 6 (every day). Finally, we took into consideration also the *age* of respondents. The descriptive characteristics of the used variables are shown in table 1.

Table 1: Descriptive statistics of the used variables

Variable	N	Mean	Std. dev.
Relationship development	255	5.1622	0.7546
Self-awareness	255	5.2107	0.6656
Self-efficacy	255	4.9181	1.0570
Technical competence	255	4.8728	0.7474
Willingness to learn	255	5.3990	0.5966
Stay abroad	255	2.8300	1.4090
IB course	255	1.4700	0.5080
Interactions	255	2.5400	1.8160
Age	255	21.890	1.7750

Source: own processing

Among the particular dimensions of GBL, students on average reported the highest score in the willingness to learn dimension, accompanied by the lowest standard deviation, which indicates similar attitudes of the students in this dimension. On the other hand, the lowest score was reached in the dimension of technical competence, i.e. knowledge about international business, with relatively higher variation among students in this regard. This can be related to the fact that the majority of students (i.e. 53%) have not taken a course related to international studies/ international business yet. The average score is 1.47. With regard to stay abroad experiences, average student traveled outside of home country for short visits or for shorter (4 weeks or less) study abroad programs. Only 24% of students lived or studied abroad for more than one month. Students in our sample on average interact with people from different countries two or three times a month. The average age of our students is almost 22 years, what is influenced by the relatively high portion of master students in our sample.

In is in our interest to investigate the effect of stay abroad experiences and other potential determinants such as taking an IB course, interactions with foreigners and age on a level of global business literacy, which is evaluated through its five dimensions. For this purpose, the regression and the correlation analyses were applied. Table 2 shows Pearson correlation coefficients between each pair of potential determinants of GBL, as well as between the pairs of these determinants and dimensions of GBL.

Table 2: Correlation matrix

	Stay abroad	IB course	Interactions	Age
Stay abroad	1			
IB course	0.218***	1		
Interactions	0.410***	0.092*	1	
Age	0.103*	0.296***	0.014	1
Relationship development	0.195***	0.203***	0.245***	-0.112**
Self-awareness	0.014	0.163***	-0.062	0.060
Self-efficacy	0.361***	0.162**	0.317***	0.007
Technical competence	0.207***	0.319***	0.251***	0.210***
Willingness to learn	0.099*	0.097*	0.120**	-0.036

Note: *, **, *** denote statistical significance at the level of 10, 5, or 1 %, respectively.

Source: own processing

Although the correlation matrix shows some statistically significant relations between the pairs of potential determinants of GBL, the strength of relation is rather small, thus we do not expect multicollinearity problem in the regression models. At the same time, we expect that some of the potential determinants will have significant effect on some of the dimensions of global business literacy, which form dependent variables in the subsequent regression models.

4 Results

Our analysis was aimed to determine the factors that potentially influence particular dimensions of global business literacy. We are interested especially in the impact of stay or study abroad experiences in this regard.

Following table presents the results of the regression analysis, within which five regression models were constructed, each of which is dedicated to one of the dimensions of global business literacy forming the explained variables. As explanatory variables were used stay abroad experiences, taking course related to international business, frequency of interactions with foreigners and age. Results of linear regression analysis are shown in table 3.

Overall, all models are statistically significant according to F-statistics and report no autocorrelation problem (values of Durbin-Watson test are around 2), except for the last model. At the same time, there is no multicollinearity issue (values of VIF are close to 1).

Table 3: Regression results (t values in parentheses)

	Model 1	Model 2	Model 3	Model 4	Model 5
Dependent variable	Relationship development	Self-awareness	Self-efficacy	Technical competence	Willingness to learn
Constant	6.105*** (10.995)	4.864*** (9.418)	4.441*** (5.860)	2.856*** (5.313)	5.618*** (12.103)
Stay abroad <i>VIF=1.255</i>	0.47 (1.328)	0.005 (0.143)	0.196** (4.059)	0.029 (0.858)	0.020 (0.664)
IB course <i>VIF=1.141</i>	0.330*** (3.523)	0.217** (2.492)	0.212* (1.659)	0.368*** (4.058)	0.116 (1.484)
Interactions <i>VIF=1.204</i>	0.080*** (2.962)	-0.030 (-1.198)	0.117*** (3.197)	0.084*** (3.218)	0.031 (1.361)
Age <i>VIF=1.099</i>	-0.081*** (-3.063)	0.004 (0.169)	-0.031 (-0.874)	0.054** (2.118)	-0.024 (-1.086)
Adjusted R ²	0.116	0.017	0.161	0.156	0.012
Durbin-Watson	1.963	1.950	2.106	1.868	0.886
F stat.	9.371	2.129	13.200	12.716	1.791
<i>Sig.</i>	0.000	0.078	0.000	0.000	0.131

Note: *, **, *** denote statistical significance at the level of 10, 5, or 1 %, respectively.

Source: own processing

The first model shows factors that influence the ability to develop relationships with foreigners. Among the investigated factors, except for the constant, the highest positive statistically significant impact has taking a course related to international business, followed by the frequency of interactions with foreigners. Surprisingly, age play a small negative role in this regard. In the second model, which is explaining the self-awareness, only one statistically significant factor is evident, namely the course related to international business, which has a positive effect.

In the case of the third model, which shows the factors determining self-efficacy, the IB course is marginally significant, besides other two positively statistically significant factors, namely stay or study abroad experiences and the frequency of interactions with foreigners. The last mentioned is significant factor also in the case of fourth model, explaining the technical competence, i.e. the perceived level of international business knowledge. The other two positively significant factors are the IB course and the age of respondents. In the fifth model, except for the constant, none of the investigated factors is statistically significant and the adjusted R² of the model is very low. Thus, it seems that the dimension of willingness to learn is determined by other factors than we considered in our study. Moreover, according to F-statistics, the model is not statistically significant.

5 Discussion

When looking at the potential determinants of global business literacy, it can be concluded that among the investigated factors, taking a course related to international business or international studies plays the most important role. It positively significantly affects four of the five dimensions of GBL. Frequency of interactions with foreigners is positive and significant in three of the five GBL dimensions. Thus, it appears that some aspects of global business literacy, particularly technical competence, self-efficacy and relationship development, can be well developed through internalizing activities at home. Meng et al.

(2017) also investigated the effects of enrolment in courses related to internationalization and the contacts with foreigners through domestic campuses activities in the Chinese context and found that both of these factors are significant predictors of students' global competence. This is basically in line with conclusions provided by Fakhreldin et al. (2021) who suggested that the implementation of well-designed cross-cultural management courses supplemented by experiential and blended teaching techniques can replace international exposure.

Age has a small significant but rather controversial effect on two GBL dimensions. It is positively associated with technical competence, which should be a logical consequence of the acquisition of more knowledge by older students, but negatively associated with the development of relationships, which may reflect the curiosity of younger students to develop new relationships.

The stay abroad experiences positively influence all the dimensions of GBL, however, statistical significance was shown only in the case of self-efficacy. In general, it can be concluded that the more time a student spends abroad, the higher is the achieved self-efficacy. Similar findings were presented in the study by Petersdotter et al. (2017), who in addition showed that the number of social contacts encountered per week mediated the development of higher self-efficacy abroad. Frequency of interactions with foreigners is an important determinant of self-efficacy also within our study. In the similar sense Genkova and Kruse (2020) also concluded that students' show more cultural intelligence, the longer they stay abroad.

However, our study also revealed that there are other factors that determine the level of global business literacy that we did not consider. Among other factors that can possibly influence the students' intention to study abroad and gain specific competencies, personality traits (Niehoff et al., 2017) or students' socioeconomic background (Hübner et al., 2021) can be considered, which should form part of the future research. At the same time, our study did not strictly distinguish the purpose

of the stay abroad, so the findings may differ slightly when distinguishing study and vacation abroad, which constitute our future research ambition.

6 Conclusion

This study aspired to evaluate the effects of stay abroad experiences and other factors on cultivation of global business literacy of business students in the Czech Republic and Slovakia. The own research was carried out on a sample of 255 university students and the data were processed using correlation and regression analysis. The results show that the length and intensity of stay abroad significantly and positively contributes only to the development of self-efficacy dimension of GBL.

The remaining dimensions seem to be well developable by other means, such as specific courses related to international business enriched with experiential teaching techniques based e.g. on online contacts with foreigners. Fostering these interactions appears to be another important factor for the development of the most dimensions of GBL. These factors can be supported not only during international exposure, but also through internalization at home and can thus be available to all students, including those who cannot afford to study abroad.

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Primary Paper Section: A

Secondary Paper Section: AE, AM

SOCIO - ECONOMIC ASPECTS OF DEMENTIA IN CONTEXT OF THE SLOVAK REPUBLIC

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Abstract: Various types of dementia are currently included among the diseases that cause concern in society. The aim of the study is to provide an insight into the situation in the field of social care for seniors with dementia in Slovakia in the context of current global trends. We will use secondary data analysis (SDA- Secondary data analysis) of the institutions examining these data for these findings. Our findings point to the fact that there will be a lack of financial resources in Slovakia, and there will be a shortage of qualified nursing staff needed to provide health and social care services. In 2021, the number of seniors over 65 in the Slovak population exceeded 17%, which increases the number of elderly people with an unsatisfied need in the field of social services due to dependency.

Keywords: social work, social services, population, dementia, socio-economic aspects, Slovakia.

1 Introduction

The current global demographic trend is characterized by two facts. The first is the unprecedented increase in the global population and the second is its aging. The current population of the Earth exceeds 8,044,383,550¹ people. Despite the permanent increase in the global population in economically developed countries, the trend of low birth rates persists for a long time, which, in conjunction with the increasing average life expectancy, is changing the shape of the so-called age pyramid. This trend also applies to EU countries. Changes in the structure of the population, which is characterized by a significantly older age, have already been seen in several EU countries. As stated by the European Commission at this year's June meeting, the increase in life expectancy is the result of social and economic progress, progress in medicine, the availability of health care and the overall improvement of the standard of living. The EC called on member states to increase their efforts aimed at the reconstruction of society towards building a "long-term society". The Long-term society must be oriented towards strengthening the position of older citizens in society, supporting their well-being, i.e. supporting the mental and physical well-being of seniors. At the same time, EC pointed to several risks of a long-lived society. A concomitant phenomenon of a long-lived society is a decline in the birth rate, which in the future means a decline in the productive work force. The expected work force shortage will put pressure on the public budgets of individual EU states and threaten the competitiveness of the EU as a whole (EC, 2023). A decrease in the working-age population will cause a decrease in income from personal taxes and contributions to social security and health care.

This trend can be fully manifested in the next decade, when the so-called baby boomers, i.e. people who were born between the mid-1940s and the mid-1960s. The arrival of a large number of individuals into retirement will not only create a disproportionate pressure on public budgets for social security resources, but will also bring other problems secondarily. Among the most serious of them will be the lack of manpower, primarily in the field of health, but especially social services. The aging of the population can be the cause of increasing expenditures on health and long-term care, as well as on pensions. Qualified estimates assume that in 2040 it could represent almost 27% of GDP (EC, 2023, Alzheimer's Association, 2020).

WHO even admits that the percentage of GDP may be even slightly higher, given that the aging of the population is accompanied by a higher incidence of diseases requiring treatment and follow-up care. Various types of dementia are currently included among the diseases that cause concern in society.

2 Methodology

The aim of the study is to provide an insight into the situation in the field of social care for seniors with dementia in Slovakia in the context of current global trends. We used secondary data analysis (SDA), which Castle (2003) characterizes as research in which researchers use data that was originally collected for another study. Secondary data came from the databases of the World Health Organization (WHO), Eurostat, Digital Europa Thesaurus, European Commission, CSWD, Alzheimer's Association, Alzheimer's Study Group (ASG), Statistical Office of the Slovak Republic, Ministry of Labour, Social Affairs and Family of the Slovak Republic, National Health Information Center SK. SDA has several variations. In our case, we used data collected from multiple sources to answer our own research questions (Hinds, Vogel, and Clarke-Steffen 1997, Szabo and Strang 1997). We were wondering if Slovakia is ready for the rapidly increasing number of seniors with dementia? We also wanted to find out what the most serious risks the Slovak company will face.

3 Are we facing a dementia pandemic?

On December 9, 2020, the WHO officially included Alzheimer's disease and other forms of dementia among the 10 leading causes of death worldwide for the first time (WHO, 2020). Dementia is a disease that has accompanied humans for millennia. Even at the beginning of the 20th century, this disease was perceived as one of the accompanying signs of aging (Alzheimer's Association, 2023). What has changed that dementia, and especially Alzheimer's disease as one of its forms, is causing concern in the global world? The combination of the aging of the population with the increase in the incidence of dementia and the cost of their treatment, and especially the personnel and economic demands of ensuring subsequent, long-term care, is causing concern (Alzheimer's Association, 2023, Alzheimer's Association, 2020).

Dementia is an acquired disorder of memory and other cognitive functions, as a result of which the affected individual initially experiences a deterioration in social functioning and, in the final phase, even a complete loss of social functionality. In addition to the gradual loss of memory, dementia is associated with a learning disorder, a disorder of orientation in time and space, a gradual decline in abstract thinking, logical reasoning, disorders in the field of visual-spatial perception, decision-making, and communication disorders. Along with problems with memory, language and the ability to make decisions, dementia can also be accompanied by other problems such as: sudden mood changes, increased irritability, depression, anxiety, or aggression. Some people with dementia cannot control their emotions and their personality can change.

The severity of dementia ranges from the mildest stage, when it is just beginning to affect a person's functioning, to the most severe stage, when a person is already completely dependent on others for basic life activities. It is characteristic of dementia that changes come gradually, while the dynamics of these changes cannot be clearly forecast (Dixon et al., 2022, Nitrini et al., 2020). From the point of view of social work, this means that a client who shows some of the symptoms of dementia will need long-term care in the foreseeable future. From a medical point of view, clients with dementia largely belong to people with so-called multimorbidities (Devi, et al., 2022, Georges, et al., 2008). As reported by Spiers et al. (2023) clients with multimorbidities are characterized by repeated hospitalization,

¹ It is necessary to look at fact, that this number is changing constantly, because it is estimated that "new human being" is born every second.

which increases the demands on overall health and social care, reduces the quality of life and increases the risk of death. If such individuals live at home, there are frequent problems with the coordination of primary, community, secondary and tertiary care, which causes difficulties not only for clients, but also for their families and professionals who are involved in providing the necessary care (Damarell et al., 2020). It is precisely the complications associated with providing the necessary care, which is also economically demanding with the classical approach, that the search for more optimal variants began. The classic approach in social services is based on assigning an individual to existing generally designed services. Welfare states financially support institutions and organizations that provide specific social services to certain client groups (Beresford, 2007). Against this approach stands the concept of personalized care, which was developed in Great Britain and was strongly influenced by liberal economic-social concepts.

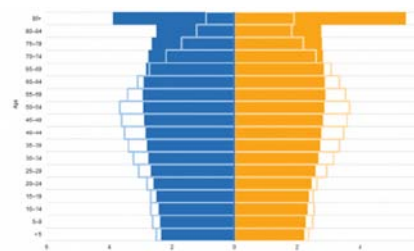
The basis of this approach can be found in the fight of persons with disabilities to be independent life (Lybery, 2012). Personalization has brought a new perspective on care and support services. The philosophy of personalization emphasizes the uniqueness of each person and respect for their human rights, including the right to decide on the form and type of assistance necessary for their independent functioning. In this way, the center of attention is not the institution providing care, but the person with his strengths, preferences and aspirations. Personalized social care prefers providing financial contributions directly to individual's dependent on care, who subsequently finance social services themselves (Beresford, 2007). Personalization is a political paradigm whose goal is to achieve better social care and at the same time reduce fiscal pressures on the government by offering the citizen the possibility of choosing from a wider range of social services and a higher degree of control over his own life (Carey, Crammond, Malbon, 2019). Proponents of personalization emphasize that this approach focuses on identifying the subjective needs and desires of individuals, but also of entire communities, and subsequently ensuring a sufficient amount of valid information necessary for autonomous decision-making. The basic principles of personalized social care are thus autonomy, respect, freedom, choice, control over one's own life. The goal of personalized care is to enable clients to access the so-called general services such as health care, housing, active leisure time, transport, etc.

Personalized care means that people have choice and control over the way their care is planned and delivered. It is based on "what matters to them" and their individual strengths and needs. This care prefers providing care in the client's natural environment. If this is not possible, then he prefers a community form of care to a residential one (Lybery, 2012) Personalized care represents a new relationship between people, professionals and the health and social care system. Experts focused on the care of clients with dementia are convinced that personalized care enables the fulfillment of the basic ethical principles of social work and significantly contributes to the quality of life of clients with dementia.

4 Is Slovakia ready to manage care for clients with dementia?

In 2019, within Eurostat, a forecast of aging in the EU for the years 2019-2100 was developed, reflecting a process referred to as the aging of the population from below, which is graphically captured in the so-called population pyramid.

Figure 1 Population pyramid of aging, EU 27, 2019 and 2100



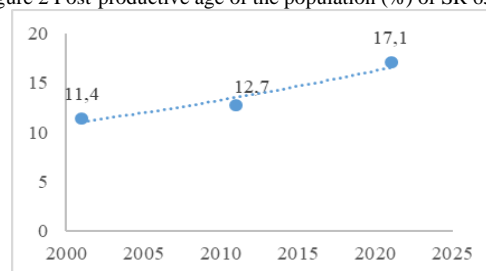
Source: Eurostat (2021).

The graph clearly shows the trend of a shrinking productive part of the EU population, which can contribute to the health care and social security systems in the years to come. However, within the EU countries, not only will there be a lack of funds, but there will be a lack of qualified personnel needed to provide health and social care services. In several member states, this problem has already fully manifested itself.

If in 2019 people in the age category 80 plus made up 5.8% of the total number of EU residents, it is expected that this category will increase two and a half times by the year 2100. In the year 2100, the percentage of the population aged 80 plus should reach 14.6% (EC, 2023).

The situation in Slovakia is worse compared to the EU average. The current average life expectancy of Slovaks is 77 years. By 2040, the average Slovak should live to be eighty years old. The Slovak population has aged significantly in 20 years. According to the 2001 Census of Inhabitants, Homes and Apartments (Statistical Office of the Slovak Republic, 2021), 11.4 percent of the population in post-productive age (65+) in Slovakia. In 2011, the number increased to 12.7 percent, and in 2021, seniors over 65 in the Slovak population will exceed 17 percent.

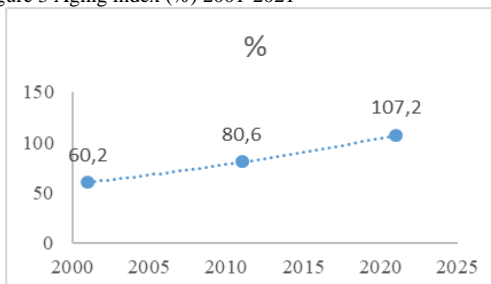
Figure 2 Post-productive age of the population (%) of SR 65+



Source: own processing.

Slovakia is among the fastest aging EU countries, as evidenced by the aging index. The aging index expresses the ratio of persons in post-productive age to persons in pre-productive age. It can be seen from the data of the Statistical Office of the Slovak Republic, that the aging index increased exponentially during the last three censuses. If in 2001 the aging index was 60.2, in 2011 it was already 82.6 and in 2021 it exceeded 107.

Figure 3 Aging index (%) 2001-2021



Source: own processing.

In addition to the aging of the Slovak population, it is also necessary to take into account the general state of health of the Slovak population. The following table shows the estimate of the

prevalence rate of dementia among residents 60 plus per 100,000 from 2019.

Table 1 Estimates of dementia prevalence rate per 100 000 among older adults (≥ 60 years) in the EU in 2019

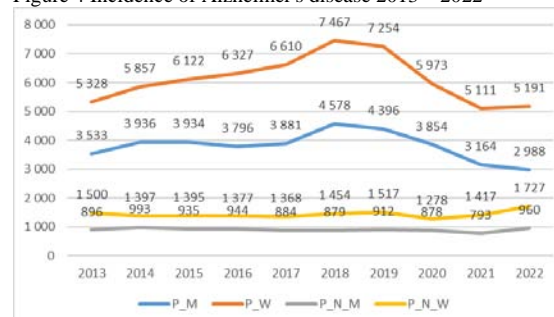
Countries	Age standardised	60-64 years	65-69 years	70-74 years	75-79 years	>80 years
Belgium	633	678	1 354	2 919	6 242	18 555
Bulgaria	741	760	1 635	3 653	7 449	19 141
Czechia	773	813	1 728	3 826	7 822	21 750
Denmark	594	642	1 297	2 783	5 867	17 123
Germany	674	674	1 399	3 105	6 712	18 644
Estonia	754	773	1 662	3 671	7 570	20 859
Ireland	627	623	1 321	2 937	6 268	17 950
Greece	626	675	1 364	2 952	6 273	17 545
Spain	631	704	1 440	3 113	6 475	17 936
France	640	686	1 398	3 034	6 427	19 163
Croatia	775	798	1 739	3 897	7 852	20 174
Italy	742	757	1 543	3 449	7 556	21 643
Cyprus	634	675	1 355	2 926	6 259	15 859
Latvia	725	733	1 571	3 464	7 192	20 041
Lithuania	732	774	1 608	3 502	7 271	19 939
Luxembourg	559	650	1 257	2 610	5 430	16 071
Hungary	767	774	1 690	3 810	7 820	21 415
Malta	628	638	1 325	2 919	6 253	18 109
Netherlands	678	680	1 441	3 253	7 042	19 255
Austria	630	661	1 348	2 937	6 262	18 508
Poland	771	805	1 720	3 767	7 733	21 702
Portugal	642	696	1 387	2 980	6 331	18 151
Romania	750	799	1 675	3 680	7 522	19 894
Slovenia	788	848	1 782	3 923	7 977	22 474
Slovakia	762	767	1 682	3 800	7 770	20 957
Finland	624	641	1 318	2 883	6 176	18 520
Sweden	571	631	1 218	2 538	5 399	17 298

Source: Digital Europa Thesaurus (DET) (2021).

From the point of view of the aging index as well as the economic burden index, in 2060 Slovakia will be ranked among the EU28 countries with the highest prevalence of senior citizens and the highest burden on the productive component of the population. It is necessary to respond to this with public policies oriented towards the support of all age categories and the use of people's potential throughout the life cycle as a basis for building sustainable societies.

Long-term care and access to it in the Slovak Republic is characterized by different financing of its health and social components (compulsory public health insurance vs. resources from the state budget, budgets of higher territorial units and budgets of municipalities within the framework of social assistance to the dependent), a lack of qualified nursing staff, or a high number of elderly persons with an unsatisfied need in the field of social services conditioned by dependency. According to data from the Ministry of Labour, Social Affairs and Family of the Slovak Republic in 2019, there were almost 10.8 thousand seniors waiting for residential social services. This number is increasing year by year. If the Slovak Republic wanted to satisfy 11,000 applicants, we would need to build and equip 275 facilities for seniors in Slovakia. In parallel, SR will also have to build community services for seniors and look for support options for informal caregivers. We can assume the occurrence of some type of dementia in some of these seniors. Similar to other countries, the current state of residents who have been diagnosed with some form of dementia does not correspond to the real situation in the Slovak Republic. WHO (2020) assumes that about a third of the number of people actually affected by dementia is actually diagnosed. The following graph shows the incidence of Alzheimer's disease in the years 2013 to 2022.

Figure 4 Incidence of Alzheimer's disease 2013 – 2022



Source: own processing.

However, the quality of life in old age is a completely different value. It depends on volatile variables such as health, social ties and above all, financial security. SR has long been struggling with the finances necessary to cover the costs necessary to ensure the quality of senior's life in general and especially seniors with some form of dementia and their families.

5 Economic aspects accompanying dementia

The exact financial requirements for providing comprehensive care for people with dementia cannot be quantified. For a long time, WHO has been trying to establish at least a qualified estimate of the total costs, namely in the health sector, in the area of social care services and in the household. In 2020, based on a retrospective analysis, the WHO published a forecast, in which it also stated that the worldwide number of diagnosed people suffering from some form of dementia will double every 20 years. The forecast of the development of dementia in the global area for the years 2030 and 2050 was also based on this fact.

In 2020, according to WHO (2020), 55 million people with dementia were confirmed worldwide. In 2030, the WHO expects that 78 million people will be diagnosed with dementia. The forecast for 2050 is 139 million people suffering from some form of dementia (WHO, 2020, EC, 2023). According to WHO findings (2020), 10 million new diagnosed cases are added annually, which means that a newly diagnosed person is added every 3.2 seconds.

In 2019, the annual global societal cost of dementia was estimated at US\$1313.4 billion for the 55.2 million people with dementia, equivalent to US\$23,796 per person with dementia. Of the total, \$213.2 billion (16%) was direct health costs, \$448.7 billion (34%) direct social sector costs (including long-term care), and \$651.4 billion (50%) informal care costs (WHO, 2020, EC, 2021, CSWD, 2023).

Similar conclusions were reached by Mattap et al. (2022) who examined the economic impacts of dementia on low- and middle-income countries. According to their findings, up to 58% of dementia costs are indirect costs related to care provided in the home environment. Annual per capita costs ranged from \$590.78 (in the early stage) to \$25,510.66 in clients with severe dementia (Mattap et al., 2022).

The economic costs of providing care for people with dementia are increasing worldwide. Currently, even countries with traditionally strong intergenerational family ties are no longer able to provide care in familia, i.e. within the family. When it is necessary to deal with care in the home environment, they often employ unqualified nannies with low education, which reduces and sometimes even threatens the quality of life of the cared-for family member. There is no single way of calculating the costs of dementia care. These need to be evaluated in each country using harmonized methods for planning financial means to meet the needs of people living with dementia and their carers as well as the costs of providing health and social care.

Experts point to the fact that health and long-term care costs for people with dementia have increased by more than 300% in the US over the past period (Hill, et al. 2002). This trend of rising

costs was confirmed by Boustani et al. (2007) Frytak et al. (2008), but also for the Netherlands (Elo, Kyngäs, 2008) Kaplan and Berkman (2011) talk about a global problem.

6 Discussion

It turns out that the incidence of dementia is related to overall living conditions. Up to 60% of all individuals with dementia live in low- and middle-income countries. It is expected that in 2030 it will be up to 71%. Most people with dementia currently live in China, India, South Asia and the Western Pacific. The estimate of undetected (that is, diagnostically unconfirmed dementias) in economically developed countries varies between 20-50%. In economically less developed countries, more than 70% of people actually suffering from dementia remain undiagnosed. In India, up to 90% are undiagnosed and therefore untreated. It is estimated that up to 3/4 of people who actually have dementia have not been diagnosed globally (WHO, 2017, EC, 2023). These estimates are confirmed by several authors whose research focuses on mapping the incidence of dementia. According to them, the actual number of people with dementia is unknown because many people, especially in the early stages, are not diagnosed (Prince et al., 2015; Van Den Dungen et al., 2012).

A low level of education is another known risk factor for dementia. It is usually associated with low socioeconomic status and reduced access to health care from prenatal to advanced age. In addition, low educational attainment is also associated with low cognitive reserve (Stern et al. 2018, Joubert et al., 2008), which may lead to an earlier manifestation of dementia symptoms. It is important to note that all of the above factors are modifiable and therefore cognitive impairment and dementia related to these aspects are preventable. In 2017, Livingston et al. (2017) suggested that nine potentially modifiable risk factors (lower childhood education, midlife hearing loss, hypertension and obesity, later smoking, depression, physical inactivity, social isolation and diabetes) account for 35% of global dementia cases. New research suggests that a person's lifestyle and environment also contribute to the risk and progression of Alzheimer's disease. Among the confirmed factors involved in the development of dementia is also a polluted environment, especially air, and lifestyle, especially lack of exercise. In recent years, the influence of changing climatic conditions has also been monitored as a potential source contributing to the development of already diagnosed dementia.

Despite the indisputable medical progress, the current known biomedical interventions can only provide symptomatic relief to a limited extent and cannot prevent the further progression of the disease. This fact shifts care from exclusively medical facilities to home, community or residential social care. At the same time, informal caregivers are expected to be able to provide their relatives suffering from dementia with the necessary psychosocial support and help in managing activities related to daily life (Kaplan, Berkman, 2011). Since almost 70% of the necessary care for people with dementia is carried out in the home environment, in several countries the financial costs necessary to ensure this care are monitored (AA, 2009, ASG, 2008). Mattap et al. (2022) in their study warn of the risks associated with insufficient data collection at the national level of individual states, which do not allow for high-quality analyzes necessary for the subsequent planning of funds for the further development of care for people with dementia. Slovak Republic is included in the states that lack qualitative statistics in the field of social services and informal care, which, moreover, does not even have integrated health and social care. We understand these two facts as serious risks for the further provision of social care for persons with dementia at a sufficiently high quality level. Hospice care is associated with residential care (McClendon et al., 2006). Social work as a profession is ready to meet the needs of people with dementia and their families. In the near future, social workers should play a key role in providing, securing and organizing care for seniors with dementia. Their undergraduate training provides them with enough skills to provide psychosocial support, counseling, or social therapy (Berkman et

al., 2005). A problem associated with residential social care is the low number of social workers with geriatric specialization (Kaplan, Berkman, 2011, Boustani et al., 2007). However, in the conditions of Slovakia, after 1990, the geriatric nurses who alternated the positions of geriatric social workers before 1990 were gradually abolished. The situation is currently aggravated by the fact that in the coming years Slovakia will face a serious shortage of professional personnel in connection with the departure of employees in the social services sector to retirement. The demanding nature of the work combined with the low remuneration also contributes to the low attractiveness of this profession in Slovakia. Kaplan and Berkman (2011) drew attention to a similar situation abroad. If individual states are unable to bridge the aforementioned risks, social work as a profession will have to become more involved at the macro level in order to advocate for the cost-effectiveness of comprehensive care for seniors with dementia and their families (Berkman et al., 2005, Bures et al., 2002).

7 Conclusion

As the senior population grows, so will the number of people suffering from dementia, with Alzheimer's disease expected to be the most common type. As a result, the demand not only for specialist doctors will grow, but the pressure to ensure long-term social care in the home or community environment may increase disproportionately. We are entitled to expect that the demand for residential forms of care for clients with a reduced or minimal degree of independence will also grow rapidly. For this group of clients, it will be especially necessary to have enough qualified personnel to form an interdisciplinary team. Thus, completing the development of integrated social and health care and solving problems with adequate financial evaluation of the staff in order to stabilize them is a key question for the future for Slovakia. Sufficient funds must also be generated to cover operating costs for day care centers and specialized services. High-quality analyzes and forecasts are essential for effective planning and ensuring the necessary care. In the Slovak Republic, however, the collection of data necessary for subsequent analytical processing is insufficient. Data on the number of cared-for individuals in the home environment and the economic costs of this care, including allowances for informal caregivers, are neither comprehensive nor structured by individual items in such a way that it is possible to estimate the future need for financial resources to cover this segment.

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Primary Paper Section: A

Secondary Paper Section: AE, AO

FUNCTION OF CULTURAL IDENTITY OF MALAYSIAN CHINESE MUSIC: A CASE STUDY OF “CHUAN DENG”

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Abstract: For over a century after the Qing Dynasty, Chinese migration to the Malay Peninsula surged, bringing challenges of new geography, diverse cultures, languages, politics, and survival. Despite this, Malaysian Chinese remained deeply rooted in their cultural traditions. Among these, Chinese music played a crucial role, serving as a spiritual anchor for Malaysian Chinese, carrying the essence of their heritage. Through surveys and interviews with teachers and students from Malaysian-Chinese secondary schools, the author investigated how Malaysian Chinese Music, exemplified by the widely embraced "Chuan Deng," holds such a profound cultural identity function within the community and its underlying principles.

Keywords: Malaysian Chinese Music; Chuan Deng; ethnic group; cultural identity

1 The Chinese music

Wherever and whenever there are people, there is music. So, what is music? Western music originated from ancient Greece and ancient Rome. The earliest records of ancient Greek music started from the time of Homer, the formative period of Greek mythology. "Music" is written in Ancient Greek as "mousike", which is a variation of the word "mousikos", meaning "belonging to the Muses". Muses are the general name of the nine goddesses in Greek mythology who are respectively in charge of music, literature, art, astronomy, science, etc.. The word "mousike" covers all the artistic fields represented by Muses, from poetry to song and dance. Music is a kind of emotional language beyond words. Susan Langer called it an "unrealized symbol", which can be a story, an image, an event, etc. In any given work, this symbol largely depends on our response [1].

The earliest form of music in China, represented by the concept of "music", is a primitive music-and-dance combining singing, dancing, and playing music, called "music-and-dance" in ancient documents. The ancient music-and-dance "The music of Ge Tian", which reflected the agricultural and pastoral life, was recorded in "Lü's Spring and Autumn Annals - Ancient Music". The content is: "The music of Ge Tian was performed in the form of three people holding an oxtail and singing eight songs with their feet: The first is "Raising People", the second is "Divine Bird", the third is "May the Lush Grass", the fourth is "Praying for a Good Harvest of Grains", the fifth is "Singing the Gifts of the Heavens", the sixth is "Singing the Praises of God's Grace", the seventh is "Singing of the Earth's Nurturing", the eighth is "Praying for More Birds and Animals From Heaven so that the People Can Live in Peace And Happiness [2].""Singing and dancing with oxtail" was a common phenomenon in ancient times and even in the Shang Dynasty.

The Chinese national music refers to all kinds of traditional Chinese music and the music developed based on it, which is also called "folk music" in mainland China, "national music" in Taiwan, and "Chinese music" in Hong Kong, Macao, Singapore, Malaysia and overseas. The "Chinese music" mentioned in this paper refers to Malaysian Chinese Music.

Malaysian Chinese Music has its origins in the god worship play, which was originally a traditional Chinese folk activity in which villagers invited the troupes to perform songs and dances to pay homage to the gods and ancestors on major traditional festivals, praying for a peaceful and happy life and a bountiful harvest, or to repay the gods for fulfilling their wishes. The Chinese who first migrated to Malaysia brought this folk culture to the region, forming the earliest Malaysian Chinese Music [3].

The emergence of Malaysian Chinese Music is due to the transformation of ethnic psychology and cultural identity under the transformation of Malaysia Chinese identity [4], which is a manifestation of the initiative of Malaysia Chinese to seek cultural identity in the environment of the three major ethnic groups (Malay, Chinese, and Indian). It is also the endless cultural inheritance of Chinese descendants overseas, and it reflects the artistic melody to prove that the Malaysian Chinese do not forget their roots [5].

1.1 The Cultural Identity

Culture is the knowledge and behavior that is specific to a particular population [6]. It does not only refer to a person's personality characteristics but also has a super-personal nature, which is created, shared, and updated by the group [7]. Identity or Identification, as an explicit term in the West, was first coined by psychologist Sigmund Freud, which means "the process of emotional and psychological convergence of an individual with another person, group, or imitative figure. In this process, individuals consciously or unconsciously attribute characteristics such as behaviors and opinions of other people or groups to themselves to seek identity [8].

At a particular time, a group of people develops their values, beliefs, language, skills, physical attributes, interests, and even religion in response to the need to adapt not only to the external environment but also as a result of learning from internal struggles within the group. Through this process, whether consciously or unconsciously, each individual will identify with a certain group of people who have similar, shared characteristics [9]. Cultural identity is a recognition and a value orientation toward a certain culture [10].

Cultural identity is the deepest and most basic manifestation of national identity, an important prerequisite for identity and emotional belonging, the deepest level of identity, the root of a nation's unity, and the soul of harmony. As one of the treasures of Chinese national culture, traditional Chinese music culture contains special ethnic identity symbols that allow Chinese people to experience the qualities of traditional Chinese music in the form of perceptive memories, festival rituals, and emotional evolution, and to express their sense of identity with the national culture contained in Chinese music.

2 The survey and analysis of the cultural identity function of Malaysian Chinese Music

Regarding the function of music, Aristotle believed that music could promote moral behavior, thus creating model citizens for the ideal state [11]. Plato believed that music could bypass reason and penetrate the core of the self, thus affecting the development of a person's character [12]. Elliott has said, "One needs to understand the nature and value of music in its entirety, and music education has a comprehensive value-rich in musical, personal, social, emotional, ethical, and other multiple purposes"

[13]. Margaret and other researchers in Australia have done a research study on the value and participation of children's music, in which all classrooms in the case of kindergarten had a habit: the use of music.

Teachers of all ages used songs to indicate to children the transition from one activity to a new one, and teachers frequently used music to teach learning content, focusing mainly on language acquisition, in which the educational function of music was fully exploited [14]. Chinese Confucian philosophy holds that the function of music is first and foremost to cultivate the body and mind, to educate, and to know manners. The essence of Chinese music is to "teach with music", to use music to change customs, and to use music as a way to govern the country, as one of the main tools to "know the rise and fall", "make relationships mellow", "teach the people to become virtuous", and "change old customs and traditions" [15].

Xunzi - Theory of Music: "Music penetrates the heart very deeply, and it touches the heart very quickly." Music can enter deeply into people's hearts and minds, and it can quickly teach the human mind and improve their cultivation. Music can enlighten people's wisdom. Victor Hugo once said, "There are three keys that open the treasury of human wisdom: mathematics, language, and musical notes." Perceiving notes and feeling music is a figurative thinking process. Music is also a language, it is a form of expressing inner feelings.

The melodies and lyrics in music are rich in philosophy, and in the process of enjoying music, one's moral sentiment is inculcated. Music can strike directly at the heart and soul is an effective means of shaping the beauty of the mind and can enhance the ability to appreciate the realm of music or art. Different music contains different cultures, and the perception of music is the process of knowing the culture. Chinese music carries the wisdom of the Chinese ancestors and their rich culture, and it is produced in a specific space-time context along with specific people, events, and backgrounds, recording the thoughts and feelings of Chinese people in a specific period and reflecting a certain period of history. It conveys a kind of "meaning beyond the music", and plays its function of cultural identity.

After the end of World War II, Southeast Asian countries became independent, and as the Chinese were seen as invaders and exploiters by the local communities, the Chinese exclusion movement swept through Southeast Asia to support, protect, and develop the local indigenous people.

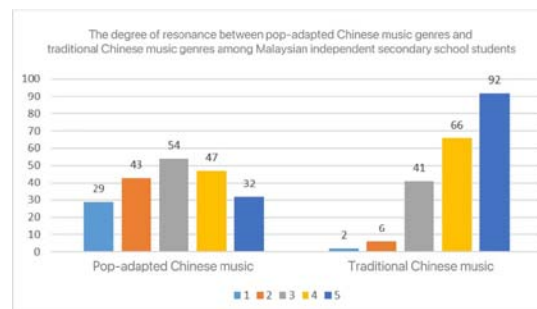
After the establishment of each government, a series of exclusionary policies were introduced, such as enforcing assimilation policies. The elimination of the Chinese community culture has seen Chinese schools bear the brunt of the closure, and Malaysia is certainly no exception.

However, with the unity and continuous struggle of the Malaysia Chinese, they finally survived the waves of racist unitary education policies and preserved elementary schools, secondary schools, and tertiary institutions with Chinese as the main medium of instruction, becoming the only "survivor" of this cultural catastrophe in Southeast Asia and the most well-developed Chinese education system outside of China, of which the existence of independent Chinese secondary schools (hereafter referred to as "independent secondary schools") is the most crucial. Most of the early dissemination and educational functions of Chinese music took place in local music organizations or orchestras.

However, with the popularization of education and the introduction of Chinese music into primary and secondary schools, and even universities, this site of educational function gradually shifted to academic institutions. Music is culturally embedded, and hearing music from a specific culture can elicit attributions to people from the same culture, suggesting that music can also be an important part of personal identity formation [16].

To explore the cultural identity function of Malaysian Chinese Music, the author conducted a questionnaire survey and interviews with teachers and students of Malaysian independent secondary schools. From March 8 to March 26, 2019, the author conducted a questionnaire survey on the cultural identity function of Malaysian Chinese Music with 207 students from 20 different independent secondary schools across Malaysia on "the degree of resonance between pop adaptations of Chinese music genres and traditional Chinese music genres among Malaysian independent secondary school students". The results and data analysis are as follows.

Table 1: The degree of resonance between pop-adapted Chinese music genres and traditional Chinese music genres among Malaysian independent secondary school students



Note: From 1-5 means least resonant to most resonant

The survey data was compiled and analyzed, and the results showed that teachers and students in independent secondary schools have a strong cultural identification with Chinese music. In the "Comparison of the degree of resonance between pop-adapted Chinese music genres and traditional Chinese music genres", the percentages of "easily moved by pop-adapted Chinese music", from least to most easily, were 29 people (14.1%); 43 people (21%); 54 people (26.3%); 47 people (22.9%); and 32 people (15.6%). For traditional Chinese music, the percentages of the 207 respondents from least to most resonant were: 2 people (1.0%); 6 people (2.9%); 41 people (19.8%); 66 people (31.9%); and 92 people (44.4%). The number of people who were "most easily moved by traditional Chinese music" reached 44.4%, while only 3.9% chose "least easily".

The distribution of this data shows that the majority of independent secondary school students are more likely to relate to Chinese music. Although the surveyed groups resonate more strongly with traditional Chinese music, they still resonate with pop-adapted Chinese music with a more even attitude, and this part reflects the surveyed group members' strong identification with Chinese national culture.

To enhance the scientific and depth of interpretation of the analysis conclusions, interview information was introduced as a supplementary aid to deepen the interpretation and explanation of the conclusions of the questionnaire data analysis. The author interviewed 2 orchestra coaches who are active in Central and South Malaysia 4 orchestra coaches who are teaching in different independent secondary schools in Central and South Malaysia and 7 graduate or active orchestra members via social networking phone. In the interview, regarding the cultural and educational function of Chinese music, Mr. Liang Hankui said, "Traditional Chinese music has a very rich flavor as well as connotation."

In terms of the moral education function of Chinese music, Mr. Liang Hankui talked about, "A Chinese orchestra is a group of dozens of people, besides learning music, they also learn to treat people and get along well with other people." In response to the aesthetic education function of Chinese music, Coach Su Zhongyang believes, "A lot of Chinese music has stories to support it so that the performers can substitute emotions and

moods into the notes.” In terms of the educational function of Chinese music for group education, Coach Su Zhongyang pointed out, “Traditional music, why not others? Local (folk-adapted) music, which can be done with fewer instruments, is not very helpful for the group (education). Traditional tunes cannot be completed without 50 or 60 people.” It can be seen that Malaysian Chinese Music instructors agree with the various educational functions of Chinese music, and with Chinese music. During the teaching process, they will have a deeper understanding of Chinese music and even the perception of Chinese culture, their hearts can be purified by Chinese music, and they can infect students to love music and even life, making people feel good, and the cultural identity function of Chinese music can be reflected.

From the analysis of the above questionnaire data and interviews, it is easy to see that teachers and students in Malaysian independent secondary schools have a strong sense of cultural identity with Chinese music. Chinese music carries the culture of the Chinese nation and expresses the cultural meaning thoughts and feelings of the Chinese nation with the help of lyrics and melodies. The process of listening to and singing Chinese music is a communication between the hearts and minds of Malaysian Chinese and the lyrics and melodies of Chinese music.

The cultural message reflected in Chinese music can evoke the Malaysian Chinese’s identification with the Chinese national culture and is important in enhancing the sense of community and team spirit among the Chinese. In Chinese music, the Chinese can understand a rhythm that allows all Chinese to communicate their emotions, thus forming a whole and creating emotional resonance and a strong sense of cultural identity.

2.1 The principle for the generation of cultural identity function in Malaysian Chinese Music

2.1.1 The Idea of Harmony in Chinese Music

A batch of bone flutes was unearthed in 1986-1987 in Jiahu, Wuyang, Henan Province. According to the tests, the bone flutes are about 9,000 years old and are products of the Neolithic period, which is the earliest date that can be traced back to Chinese music culture. This batch of bone flutes excavated in Jiahu is by far the earliest, most complete, and most numerous musical instruments in the world that can be played.

The Jiahu bone flute is made of a waterfowl’s ulna bone with the ends sawn off and the joints drilled and is 22.7 cm long with a small hole in the body of the flute. Xiao Xinghua, a researcher at the Institute of Music of the Chinese Academy of Arts, and Huang Xiangpeng, a renowned music archaeologist, conducted a tonometric study of the bone flute, and the report by Huang Xiangpeng and others, published in the journal *Heritage*, is the most authoritative report to date on the Jiahu bone flute. The report states: “..... we conclude that the scale structure of this bone flute is at least a six-voice scale, and possibly a seven-voice, all-inclusive, ancient lower Slavonic scale” [17].

It is estimated that the flute-makers used the method of punching small holes to adjust the tone difference of individual holes, reflecting the fact that the Jiahu people at that time had the basic concept of scale and pitch, and the relationship of intervals was passed down. Harmony is an important spirit of traditional Chinese culture, which embodies the profound experiences and thoughts of the ancients on the universe, heaven, and earth, and social life, and embodies the harmonious rhythm within the universe and heaven and also contains the harmonious relationship between social life, overflowing with the mutual promotion, coordination, interdependence, and coexistence between the universe, heaven and earth, and social life. The ancients believed that all things harmonize, interact, and correspond with each other. Heaven and man respond and adapt to each other. “Zhuangzi - The Way of Heaven,” says: “To understand that heaven and earth are virtuous by doing nothing is to know the fundamentals of heaven and earth so that we can develop in harmony with nature.

By relying on it to balance and harmonize the world, one can live in harmony with people. To live in harmony with people is the joy of man; to live in harmony with nature is the joy of heaven.” From ancient times to the present, the relationship between human beings and nature has been the primary issue facing human beings, and it concerns the survival and development of human beings. Around this issue, ancient Chinese thinkers, aestheticians, and educators converged on the unity of man and nature and advocated the idea of the unity of heaven and man, and the most fully expressed value form and symbolic form of this is music [18].

In ancient China, there was a kind of music called “Shao music”, which spanned the end of primitive society, slave society, feudal society, and the end of the Qing Dynasty, and was a “great music” to worship the gods of heaven and earth. It has profoundly influenced the Chinese ritual and music system. In the *Analects of Confucius*, “Confucius could not taste meat for a long time since he heard ‘Shao’ music in Qi” [19].

Shao music is the sound of all creatures in heaven and earth, the sound made by all beings. Shao music is the text of all kinds of things, through which all things are expressed centrally and beautifully, so Confucius felt the vitality of all things in heaven and earth and indulged in the best Shao music.

The earliest classification of musical instruments in China is the “Eight Tones Classification”. The word “music” is explained in *Shuowen Jiezi* as follows: “What the heart thinks and what the mouth says are the same.” The ancients said, “The eight tones are in harmony, and the gods are in harmony with each other”. The eight materials of the eight tones are earth, stone, gold, leather, silk, bamboo, Lagenaria, and wood.

The earth is the ocarina, which is a blowing instrument made of clay. The earth is the root of all things growing. It is written in the *Commentary on the Rites of Zhou*: “The earth is the root of all growth; the earth is like spitting out all things.” [20]. The earth carries all things and nurtures all things to support the people. The stone is a chime, a percussion instrument made of stone, which was a common instrument for court music. In the *Shuowen Jiezi*, it is explained that “Chime is also a musical stone” [21]. In ancient times, chimes were also called “stone”. In ancient times, chimes were also called “stone”.

Different stone chimes were of different thicknesses, lengths, and sizes, and their pitch was different, so they formed a set of several chimes. Gold is a bell; a bell is a kind of instrument that is hung up and struck with the mouth facing down. Chimes are traditional Chinese percussion instruments that began in the Bronze Age. It is made of bronze and consists of different bells arranged according to size and suspended on a huge bell stand, each bell striking at a different pitch. When gold and stone are woven together, the sound of gold and stone is the sound of heaven and earth moving together. It is used when a great festival is held and heaven and earth rhythmically move at the most sacred time. Leather is a drum, which is one of the earliest percussion instruments among primitive musical instruments.

“Drum” is made of leather, which not only refers to the instrument but more importantly, the word “drum” has a very rich meaning. In “*Military strategies of Caogui*”, there is “The first time the drum was beaten, the soldiers’ courage was boosted; the second time, weakened; the third time, exhausted.” “Drum” refers to the call of the ancestors, the call of the gods to make people rush forward. Silk, the ancient Chinese zither, the serpent, and all other stringed music contain “silk”. “Silkworm”, the insect also represents another large category of life.

The silkworm is an insect that made an important contribution to agricultural production in ancient times. The silkworm industry was one of the pillars of ancient agriculture, and after thousands of years of cultural heritage, the insect has long been integrated into traditional Chinese culture, becoming a symbol of farming culture. Insects are products of nature, and they accompanied the ancient people in the process of understanding nature. Bamboo is the material for musical instruments such as the flute, xiao, and

chi. Bamboo, after oracle bone and gold inscriptions, is “Jian”, and “jian” is composed of “book”, “dian”, “canon” and so on. Bamboo played many roles in ancient Chinese society. Before paper was invented, bamboo was one of the most important writing instruments.

There are also xiao and flute instruments, also made of bamboo, so “bamboo” has the meaning of musical instruments and music. Lagenaria, which is a calabash, such as Hulusi. Lusheng, a reed wind instrument for Miao, Yao, and Dong people in southwest China. Legend has it that the sheng was created by Nuwa, made of bamboo, about four feet long, with the tube inserted into the Lagenaria. The “Shuowen Jiezi” notes: “The sheng conveys the sound of the first month. In the first month, everything grows, so it is called sheng” [21].

Wood is a wooden doxa. Wooden doxa is a kind of doxa, a loud instrument used to warn the public in ancient China. According to Liuxie, “Wenxin Diao Long - Yuan Dao”, “These classics, like the wooden tongue and brass bells used in governance, respond to a thousand miles when they are turned on and vibrate and have been handed down like treasures from a Confucian lecture hall, truly carrying forward the light of heaven and earth and inspiring people’s wisdom.” [22].

In ancient China, the use of the wooden doxa was often associated with official acts, and gradually, many symbolic meanings were attached to it, such as comparing the wooden doxa to sages and wise men who proclaimed the will of heaven and authoritative doctrines, so that the whole world responded to this call. These eight tones represent all kinds of sounds in the world. They are the ocarina of earth, the doxa of wood, the bell of gold, the chime of stone, the zither of silk, the chi of bamboo, the gourd of leather, the Lagenaria of sheng, and so on.

It is meaningful that music has been included in the book of Ruler and Calendar since ancient times, together with heaven and earth, the calendar, and so on. The Book of Jin - Calendar and the Book of Rhythm talks about it very thoroughly: “The mysterious Tao is all-encompassing, and its divine subtlety is reflected in yin and yang; the subtlety of tangible objects is reflected in rhythm and lute. The sages observed the changes of the four seasons, and made a kyu table to record the seasonal transitions; they observed the musical sounds corresponding to the five elements and cast bells to distinguish their heights, to comply with the characteristics of music to promote the nine virtues so that the music of prosperity, seriousness, and solemnity can harmoniously assist the state administration.

However, the texture of copper is like leather, so the size of the bell mouth is not easy to determine; bamboo is round and hollow, so its length is easy to cut. Therefore, the divine gaze used bamboo as a rhythm to regulate the pitch of the bell. The three rhythms of Huangzhong, Guxi, and Yizhe were determined first, and then the three rhythms of Taicu, Ruibin, and Wushe were equally divided as the above three rhythms and inserted in between, and finally, the other six rhythms such as Dalu were inserted between the above six rhythms to form the twelve rhythms, which reflects the law of nature. At the same time, also use the sundial shadow degree to adjust the seasonal moon, with the tube ash waiting for the earth, so the yin and yang reconciliation is accurate sundial shadow.

The tube can fly ashes in response, blowing its sound, it is the sound of harmony between heaven and earth.” That is to say, the melody of music, the upper follow the heavenly way, the lower effect of the earth. This is the so-called “Qionglin”, “Once the winter solstice Yang Qi first move, the reed ash will fly; autumn once the leaves on the wrong tree, only then will have fallen”. That is to say, three days before the winter solstice, in the mantle-sealed room, placed twelve reed pipes, with reed membrane burned into the ash, plugged with the mouth of the pipe, waiting for the winter solstice, because the Yang Qi rises, the mouth of the pipe of ash will fly, to respond to the time of the earth.

The sound of the reed pipe of corresponding length is the “sound of harmony between heaven and earth”. This is the keynote of all music. It is equivalent to the “center” of the music score nowadays. Chinese music, which contains the “sound of harmony between heaven and earth”, purifies the heart, sublimates the realm, unifies heaven and man, and achieves elegance, tranquility, transcendence, and spontaneity. Music is not only an expression of individual life, but also a kind of symbiosis between man and man, between man and society, and between man and nature. From the harmony of music to the harmony of people, the harmony of family and nation, and then elevated to the essence of things and the law of heaven and earth. That is the music of harmony and symbiosis [18].

According to Cassirer, “Man is a symbolic animal”. He creatively defines man as an animal symbol, that is, an animal that can use symbols to create culture. Man can create the world of culture, and on the other hand, the world of culture in turn acts on man, and the symbolic system of culture invariably influences all of man’s external perceptions and internal ideas. As musical and cultural symbols, the eight tones link nature, heaven, and earth with human beings, reflecting the idea of harmony in Chinese music. The “harmony” of the eight tones includes two levels of meaning: the inner “harmony” and the outer “harmony”.

Internal “harmony” refers to the harmonious properties of the music itself; external “harmony” is the purpose of the eight tones, which is to give aesthetic pleasure to the listener to achieve inner harmony and maintain social harmony. The internal and external “harmony” together embody the value of the eight tones as symbols of communication between nature, heaven and earth, and human beings.

Man, and society, man and nature, are the two major elements of reality. The existence of nature not only affects man’s life but also his feelings and thoughts. People are bound to build their cultural structure in their living environment with realistic cultural activities. “Harmony” is rooted in the soil of Chinese culture, and traditional culture is inherently characterized by “harmony”. The Chinese ancestors lived in a relatively isolated continental environment for a long time and formed a large unified social pattern early on, mainly engaged in agricultural production with the rotation of the seasons and the growth of collections.

Agricultural production was highly dependent on changes in weather and physical conditions. According to records, the understanding of the changing seasons was formed as early as the Xia Dynasty. “For the original (innate), nature will not be violated in the course of its operation, while for various phenomena (posterior), they will only appear at the right time.” The long-term agricultural production practice has shaped people’s daily lives, gradually formed people’s dependence on the nature of heaven and earth, guided people’s understanding and grasp of the laws of nature, and gradually formed a holistic and comprehensive way of thinking, and through the imitation of the laws of nature, and then establish the corresponding social order, which is called “the unity of heaven and man”.

The ancients explored the nature of heaven and earth and concluded that there are eight kinds of materials: earth, stone, gold, leather, silk, bamboo, Lagenaria, and wood, which are made into musical instruments to form the eight tones. Ming dynasty phonetician, collector Wang Bangzhi’s book “Lülü Zhengsheng”, Volume 35 to Volume 48, discusses the scale of musical instruments, the size of the instruments, the different sizes of the instruments, and the coordination of different instruments all affect the harmony and beauty of the music.

In his book, Wang Bangzhi discusses the specific dimensions of each part of the musical instruments, such as the specific data of the yellow bells of the chime and gold stone instruments, the number of silk strings used for each of the twelve rhythms of the zither, the length of each of the rhythmical pianos, and the circumference of the ocarinas and drums.

These data were obtained by the ancient people through observation of the natural world, experience in making, and ear sensitivity, which means that only when a musical instrument is made in strict accordance with certain dimensions can it be played beautifully and meet the aesthetics of people's hearing at that time. Only instruments made under such data could achieve a harmonious sound and meet the aesthetics and requirements of the people of that time. In his work, Wang Bangzhi listed the specific dimensions of the different sizes and forms of some instruments, not only for the size of the playing sound, the availability of the rhythms, and the limitations of the production conditions but also for the coordination and use of different sizes of instruments.

The different sizes and shapes, the different rhythms, and the different instruments should work together to achieve a harmonious sound. Only in this way can the music of the ancients meet the requirements of the ancient people, that is, "the eight tones are in harmony, and the gods are in harmony with each other". Traditionally, the Chinese classify the world's material elements into "five elements", namely, gold, wood, water, fire, and earth. They are not only mutually aggressive, such as water grinds fire, gold grinds wood, etc., but also harmonious, such as water giving birth to wood and wood giving birth to fire.

Their mutual grams and harmonization constitute the material world of existence. According to the philosophy of the world's mutual gram and harmony, the Chinese tradition defines the world of music as "eight tones", namely, earth, stone, gold, leather, silk, bamboo, Lagenaria, and wood as mentioned above. These "eight tones" also belong to the contradictory opposites and unity, such as yin and yang, light and dark, rigid and soft, broken and continuous, etc. The eight tones contrast with each other, and at the same time harmonize with each other and weave into music, synthesize into the world of sound, and become a symbolic system of communication between people and heaven and earth.

The idea of harmony contained in Chinese music is also reflected in the lyrics. The lyrics are composed of Chinese characters, which reflect the ancient Chinese process of living in harmony with nature. The Chinese character "一" has different meanings in different positions, for example, "三" is the beginning of all things, representing heaven, earth, and man; Dong Zhongshu said: "In ancient times, the character was created with three horizontal lines and a vertical line running through it, called '王'. The three crosses represent heaven, earth, and man, and the one vertical that connects them becomes the '王'." This explains that people should respect heaven, and the earth, and cherish all things. "Nature made heaven and earth and also made me, I co-exist with all things in heaven and earth, unified in nature." These three "crosses" illustrate the close relationship between heaven, earth, and man, and the addition of a "vertical" to make "王" indicates the "unity of heaven and man" [23].

It can be seen that "the thinking of the Chinese character is why the Chinese character is there" [24], which means that the construction of the Chinese character itself is the process of shaping the thinking, and it is carrying strong harmonious thinking. The creation of a Chinese character is the product of gradual agreement through the process of countless years of change, the cognitive interplay of human thinking, the repeated accumulation of experience, and gradual evolution, which itself reflects the Chinese nation's habit of thinking in opposition and unity and the cultural psychology of symmetry and harmony. Chen Yinke: "Explaining a Chinese character is often a history of Chinese culture." It is a comprehensive and systematic way of thinking; whose main characteristic is an image. Chinese characters are symbols that record the Chinese language, symbols that carry rich and deep historical and cultural information as society progresses.

Chinese characters are formed through the psychological and complex thinking system of ancient people, covering all aspects of ancient social and cultural life, such as the laws of nature and the universe, ethics and morality, religion and philosophy, clever wisdom, people's labor, customs, and manners, etc. They are the concentrated body of history and culture, and are the "living fossil". From the systematic viewpoint of all scripts, only Chinese characters imply a soft power. Understanding the cultural heritage of Chinese characters, like a clear stream flowing in the heart, reaches inner peace, harmony, self-control, and stability.

Beautiful music, with its beautiful melodies and rich lyrics, reflects a kind of resonance between people and nature and heaven. Such resonance can make people feel life according to the harmonious melody they experience, and under the guidance of beautiful music, people can live together harmoniously, forming a peaceful, friendly, and lively social situation of common survival and common development. China has been a country that attaches great importance to harmony since ancient times, and the idea of harmony embodied in the eight tones of harmony as a symbol of music culture contains the cultural accumulation of China's ancient civilization of more than 5,000 years.

Human beings can accumulate, increase, pass on, and transcend time and space through the creation of symbols to form human education. Human education, in essence, is also a creative process in which future generations learn from their predecessors, and this process of learning and transmission needs to be realized by symbols. In the process of passing on Chinese music culture, Chinese people can learn from the lyrics the figurative and harmonious way of thinking contained in its words, and experience the idea of harmony contained in Chinese music.

2.1.2 The Representation of Chinese National Cultural Symbols and Their Identity

"Symbol" is the core concept in Ernst Cassirer's philosophy. In Cassirer's philosophy, man, symbol, and culture are inseparable, and symbol is the common essence of man and culture. And symbol as culture, we can call it symbolic form. "Symbol" is the bridge and link between man and culture. Man creates culture through symbols, which means they create a symbolic world, and in turn, this symbolic world also shapes man.

People living in different ethnic groups create cultural symbols that belong to their ethnic groups, which in turn influence people's thinking and emotions, thus influencing the construction of their cultural identity. The "Da Cihai-Ethnic Volume" explains ethnic group as a term applied in anthropology, ethnology, sociology, and other disciplines [25]. An ethnic group is "a named and self-defined human community whose members share a common ancestral myth, a common memory, and one or more common cultural elements" [26]. The concept of community highlights the organic combination of tradition, history, emotion, and mutual recognition [27].

Members of the same ethnic group create their own culture in the process of common production and life, which becomes the common historical memory of the members of the group. The culture of an ethnic group includes cultural elements such as language, gender, dress, ethnicity, religion, etc., These cultural elements are represented in the form of symbols. Among all these cultural symbols, language is the soul. In the Chinese community, the basic component of language is Chinese characters, which serve as a symbolic carrier to record the common memory of the community. The lyrics of Chinese music are composed by Chinese characters, which gives Chinese music a profound cultural connotation and influences the thinking patterns of Chinese people. At the same time, music as a language is also an important part of ethnic culture.

In social life, individuals conceive of themselves as belonging to the same cultural group as others to seek their cultural identity

[28], and music has a symbolic meaning; the process of representing musical cultural identity is the process of helping members of the community to find the sense of belonging of their cultural identity. Being in the same ethnic group, telling the same historical stories, and sharing the same language, this common relationship has created a connection between Chinese national culture and Chinese emotions among the Chinese ethnic group, forming a deep-rooted Chinese cultural identity and a strong Chinese cultural complex, making the Chinese always adhere to the belief of returning to their roots and passing on their culture from generation to generation. On the one hand, men create symbols, and Chinese people create Chinese music. As a linguistic symbol, the lyrics of Chinese music contain Chinese national culture and carry the historical memory of Malaysian Chinese, which has a heavy cultural symbolic meaning and forms a cultural identity, and this meaning is given by Chinese characters as a special symbol. Characters have a solid symbolic feature and show the degree of knowledge of the world, which is summarized in characters through abstract generalization. As the written symbols of language, characters record the content of language, carry the ideas of language, and pass on language as a cultural heritage from generation to generation.

Chinese characters are a type of character, and behind them lies the brilliant civilization of the Chinese nation. Chinese characters are the best carrier for the Chinese people to understand and pass on the culture of the Chinese nation. General Secretary Xi Jinping once said, "Chinese characters are the hallmark of Chinese cultural heritage. The Yinxu oracle bone script is more than 3,000 years away from now, and for more than 3,000 years, the structure of Chinese characters has not changed; this heritage is the true Chinese gene".

The fact that Chinese civilization has been able to develop continuously, without interruption, and has always remained vigorous is closely related to the development of Chinese character culture. For thousands of years, every Chinese character has had a process of evolution. Although it has changed different forms of calligraphy, such as oracle bone, seal script, official script, cursive script, line script, and regular script, the constant in the evolution is its writing structure, which is the process of inheriting the Chinese culture.

On the other hand, Chinese characters as symbols express the Chinese way of thinking. Zhang Shiya from Southwest University China believed that the fundamental of forming the cultural identity of an ethnic group, besides costume, custom, religion, and other "obvious" identity dimensions, there are some "hidden" dimensions in the culture. For instance, using a unique language and characters of an ethnic group that expresses its way of thinking, as well as the materialized form of its mode of thought, combining with the humanity style and nature to form a specific ethnic group's cultural and psychological field [29]. This kind of ethnic group thinking pattern carries important meaning in Chinese cultural identity. Characters are the main tool of brain thinking.

The elements of thinking are language and characters. The process of thinking operation is the process of handling language and writing. The way that the brain handles Chinese characters is just like how it handles images. Chinese characters reflect the process of how ancient Chinese could live harmoniously with nature. It is a comprehensive and systematic thinking pattern and the main feature is an image. Image analysis is a kind of analogy that carries "ambiguity". According to the overall feature of the image, it is a comprehensive comparison and not a complete quantified analysis. It does not require length, edges, or other quantification to coincide completely.

For the brain to generalize and compare the features of an image, the whole process is completed under the subconscious mind. Visual pattern judgment and verification patterns are generalization and analogy ways of thinking. It is a "character thinking pattern". There is a scholar who called it a "like thinking" pattern. "Analogy" is an important category in Chinese



logical thought, and "like thinking" is a way of thinking based on the concept of analogy [30]. The idea of "thinking by analogy" has a long history in China, and it has been discussed in many ancient Chinese philosophical works. The idea of aggregation "from analogy" became the main way of thinking in the Book of Changes [31], the "first of the six meridians" [32].

In this kind of thinking pattern, when it is in the process of applying, the result that is derived from appearance and inference, i.e. between matter and reason, does not depend on general logical rules to build up. It is so-called causality and only depends on imagination. This inference method has a sentimental and intuitive nature. That is why this kind of thinking pattern is so abstruse. The "like thinking" of the Chinese reflects that they are good at expressing their thoughts implicitly and tactfully. It also shows the thinking characteristic of how Chinese comprehend things and matters subjectively. Since ancient times, "Chinese characters" have played the role of Chinese thinking tools.

They inspired the "people's wisdom" of ancient Chinese, endowing the Chinese ethnic group with a unique emotional world. This made them obtain their wisdom a very long time ago and let Chinese civilization be inherited from generation to generation until today.

The characters of different ethnic groups represent different thinking patterns and affect the cultural identity of ethnic members. For example, Chinese characters and Western alphabets represent completely different forms of characters. The alphabet represents phonology, with visual images of pronunciation, and when written in the alphabet, words are broken down into basic phonemes represented by 20-30 visual symbols [33].

The Chinese writing system, on the other hand, requires one to memorize thousands of square characters, and when writing with Chinese characters, one needs to use pictographic and metaphorical symbols, so Chinese characters are less abstract than alphabetic characters, which express the Chinese people's figurative thinking pattern. Another example is the glyphs. The character for "弓" ("bow") is written in oracle bone inscription

as , which is a weapon used to shoot arrows. With the tough wood as the stem and the silk as the string, the arrow was mounted on the bow, and the string could be drawn and fired. The character for "弓" ("bow") in the oracle bone inscription resembles a bow of this shape. Since the shape of the back of the bow is curved, the character "弓" ("bow") also has the meaning of bending. The character "引" ("string") is written in oracle bone as , which resembles the shape of a person pulling a bow and string. The original meaning of "引" ("string") is to open the bow, which is derived from the meaning of pulling and pulling. The initial Chinese characters were mostly depicted according to the shapes of physical objects, which were vivid and had a profound impact on Chinese people's thinking patterns.

In addition, Western musical thought, when discussing music, first of all, studied it as an object, analyzing its structure, harmony, melody, rhythm, etc., with a preference for rationality, which is fundamentally rooted in the Greek spirit of inquiry and knowledge. In China, where Confucianism is the core of music thought, it is advocated that music should reflect the thoughts and emotions of the outside world, take "harmony" as the ideal, and pursue lyricism to bring deepening thoughts and emotional sublimation [34]. The above-mentioned hieroglyphic thinking and Confucianism are integrated into Chinese music, which itself is the gene of Chinese national culture and gives Chinese people a unique emotional world.

Furthermore, culture is represented in the form of symbols, which influence Chinese people's identification with Chinese

national culture. Musical and cultural symbols connect people's emotions with the unique culture, and Chinese music connects Chinese people's emotions with Chinese national culture, thus representing Chinese people's cultural identity. The term "representation" originates from psychology and was introduced into the field of mathematics education by Bruner in 1966 to describe children's thinking activities, proposing three forms of representation: active, pictorial, and symbolic for conceptual learning [35].

This word is usually understood by the meaning's "presentation" "reappearance" "recurrence" and others. Its meaning is profound and nearly covers the domain of the whole society and humanities. "Representation" is normally understood by using language to tell others or the world, or say certain meaningful words.

The world is meaningfully stated and through representation, people organize the world and reality through the act of naming its elements. It is a process in which people relate their cognition of things to a notional system using symbols. Through cultural change, from linguistics to semiotics, representation shows its significance in cultural studies. The contents of materials, notions, related behavior, and the process of cultural practices become important aspects of cultural representation. In the issue between cultural identity and cultural representation, through a series of dissertations, Stuart Hall changed the traditional questions from "Who are we" "Where did we come from" and "Where will we go to" to "Who will we become" "How are we being represented" as well as "If we are influenced how to represent ourselves" [36].

This causes the notion of cultural identity to move from a quiescent state to a dynamic state, from a subject's centralization to a subject's decentralization, and from completeness to incompleteness. A particular representation system also fixes the significance of music culture. Its cultural representation too is a practical process using all kinds of concepts, notions, and sentiments related to music, in the form of symbols that can be conveyed and interpreted. As a medium of musical representation, Chinese music has cultural connotations in its lyrics. When Chinese people hear Chinese music, their thoughts will be drawn back to history, as if they were there to experience the charm of Chinese culture, and in this process, the cultural identity of Chinese people will gradually become clear.

In addition, music has a metaphorical meaning, the representation of musical cultural identity gives people a sense of belonging to cultural identity, and Chinese music becomes an artistic expression of Chinese emotions and cultural perception. Concerning metaphor, the Greek word metaphor means "to transform, to bring", emphasizing the result of transferring one thing to another. Meta means "to come" and herein means "to carry" [37]. The ancient Greek philosopher Aristotle was the first to mention the hermeneutic research method of Metaphor [38], in which collective memory and cultural memory are metaphors that can be used to explain a range of social phenomena [39]. Timothy Rice published an article entitled "Time, Place and Metaphor in Musical Experience and Ethnography", *Ethnomusicology*. The article raised a notion related to meaning construction – "musical metaphor" [40].

Regarding metaphor, Robert A. Nisbet believed that "metaphor is a kind of approach moving from certainty to uncertainty. Meanwhile, metaphor is also a cognitive approach, the characteristic of a thing that can be verified changes into another thing in the blink of an eye almost under the state of unconsciousness [41]. Yet, these things are too strange and complicated and therefore, they are unknown to us." "Metaphor is a way of which we relate two fields of unrelated experiences in a twinkling of an eye, forming an interpretive imagery that is highly generalized." Hence, metaphor is a kind of change in nature. It is also an inevitable process of the art of music practice achieving various symbolic meanings under different contexts. In other words, once a piece of musical work with determinate meaning enters into different social and cultural fields, it may

lose its original meaning and possess new metaphorical meaning.

Under these circumstances, the metaphor of music becomes a process of creation. The system and meaning of music culture are created through this process. Meanwhile, this kind of creation is not only an individual creation but the creation of an ethnic group and history. It is the creation of time as well as the dimensions. Representation of music's cultural identity is a dynamic and changing system. Its rhythm and lyrics become the result of the behavioral and practical product.

"Human, a society and a history" becomes the occurrence of behavioral practice for an ethnic group's psychological field. "Symbol and meaning" become the significant result of behavioral practice. In Chinese music, the process of reproducing Chinese lyrics and melodies is the process of creating musical metaphors. Chinese music expresses the cultural information of a specific historical period, which makes the Chinese culture and the Chinese national sentiment of the Chinese people merge, and its cultural identity function is then expressed completely and authentically.

Finally, when the Chinese culture, which is the shared historical memory of the Chinese people, is represented through symbols, and the Chinese find a cultural identity to belong to, the Chinese develop a deep Chinese cultural complex, and this deep-rooted Chinese cultural identity makes them uphold the belief of returning to their roots and passing on their cultural heritage. For an ethnic group, its perception of past culture is a process of individual and group search for cultural identity [42], in which members of the group develop a strong sense of cultural identity [43].

As Chinese, Malaysian Chinese have a deep sense of identification with Chinese culture, and they attach great importance to returning to their roots, with a strong sense of "root culture". The character "根" ("root") has a left-right structure and is a morphophonemic character, with "木" ("tree") as the form and "艮" ("tough") as the sound. The original meaning of "艮" ("tough") is "not to give way to each other", and it also has the meaning of hardness and solidity. In the seal script, the "木" ("tree") on the left of the character "根" ("root") is like a tree, and the "艮" ("tough") on the right is like a person leaning against the tree on the left. The original meaning of the Chinese character "根" ("root") refers to the underground part of the plant except for the stem, which is extended to the origin and base of things, including the root of things and the origin of culture. Idioms related to the word "根" ("root"), such as "to grow roots" "to get to the bottom" "deep-rooted", "to trace roots" and so on, are all included in the "root culture" [44].

The Chinese people have a strong sentiment for their homeland, and "root culture" is based on the traditional Chinese ideology of recognizing and respecting ancestors and returning to their roots [45]. "The inability to return to one's roots" means that the individual is cut off from his or her original family or ethnic group, creating an unfillable gap in cultural memory, which is a typical expression of loss of cultural identity [46]. The Chinese concept of returning to their roots is closely linked to the blood and geographical ties in which they live. The Chinese nation as a group, has its own common beliefs, with which they maintain the vitality of the long-lasting continuity of the national culture. The Malaysian Chinese went down South to Nanyang, far from their homeland, and started their life overseas with a strong sense of homesickness.

Being overseas, they have to face the conflict between the Chinese national culture and the native Malaysian culture as well as other cultures. In such a difficult environment, a large proportion of Chinese still hold on to their national culture and

root firmly for their national culture.

Identifying with the culture of the ethnic group is inseparable from the transmission of the culture, i.e., "passing on the culture". Zhuangzi - The Master of Health and Life: "The firewood that takes light to illuminate things will eventually burn out, but the fire is passed on and will never be extinguished." [47].

The original meaning is that when the firewood is burnt out, the fire can still be passed on. In ancient times, it meant that the spirit of a person is not extinguished; now, it is used to refer to the transmission of knowledge and skills from generation to generation; it also refers to the inexhaustible transmission of teachers and students, or the transmission of race, lineage, culture, and spirit. The excellent Chinese traditional culture has been preserved precisely because of the cultural heritage and perseverance of the Chinese nation, which has been passed down from generation to generation.

Malaysian Chinese Music is the spiritual fire in the hearts of Malaysian Chinese, and it is only through the inheritance love, and transmission of Malaysian Chinese from generation to generation that the fire of national spiritual culture continues to burn. Malaysia's Chinese have a deep-seated national and cultural identity in their hearts, and although they are far away from other countries, they have built a strong Chinese national cohesion, which has enabled the Chinese culture to be passed on.

3 The analysis of the cultural identity function of Malaysian Chinese Music with the example of "Chuan Deng"

3.1 The origin of "Chuan Deng"

"Chuan Deng" was "born" in 1982. A Singapore poet, Mr. Toh Lam Huat, and a musician, Dr. Zhang Pan composed the song. Over the years, "Chuan Deng" has spoken of the Chinese people's adherence to their cultural traditions and their expectations for the development of their communities, and "Chuan Deng" can be regarded as a Chinese "national spiritual song" [48]. One of the backgrounds of the song was that it was the time when Nanyang University Singapore was forced to "close down", and Merged by the National University of Singapore [49].

Thus, the alumni of the university lost their Alma Mater and the Chinese community in South East Asia was extremely heartbroken. Another background was that Malaysian Chinese had a dreadfully grief-stricken and indignant life during the 1980s. Some of the government bodies and radical politicians who were racist worked together to maliciously distort the issue of Malaysian Chinese identity. They claimed that the Chinese were "immigrants" "marauders" "greedy migrants" and so on. This phenomenon of unequal ethnic relations based on one ethnicity, opposing and rejecting the construction of another ethnic identity, has been particularly evident in Malaysia after the 1990s, thus affecting the construction of Chinese cultural identity [50] [51]. They had brushed aside the fact that the country was built and developed together by the multiple races in Malaysia's history. Chinese were rumored, defamed, slandered, and attacked from all sides. Chinese were attacked and defeated in politics, economy, culture, and education respectively. From 1969 to the present, the influence of the Chinese in the political system has been waning despite their formal political participation [52].

The heyday of Chinese and Chinese political parties' participation in the political life of the country in Malaysia is gone [53]. This caused the "Lalang Operation" which many people felt sorry for. More than one hundred leaders from Chinese associations and social activists were arrested and sent to prison. "Chuan Deng" was "born" under this kind of background. The song was first sung in the Singapore Leoned' Oro prize-giving ceremony. A few students from Foon Yew High School Johor Bahru attended the ceremony and brought back the song. According to what they had memorized, they started singing the song, which caused a great shock. In 1987,

Xiao Man (Chen Zaifan) who is a poet from Johor Bahru, and a musician, Tan Hooi Song introduced the song as one of the events during the "1st Thousands of Lights Mid-Autumn Festival Celebration". Facing the sea, more than one thousand It has become the spiritual support to Chinese society, too.

3.2 The reason why "Chuan Deng" becomes an ethnic group's identity

Ernst Cassirer said, "Man creates symbols, henceforth the symbols educate the nature of man. [54]" "Chuan Deng" originated from the Buddhist culture, meaning the Saint who obtains the bodhi wisdom, like a beacon. It brightens oneself and at the same time, lightens other lamps that are in the chaotic world. The light is passed on from one to another and from generation to generation, reaching the stage of constant brightness from time immemorial. "Chuan Deng", as a kind of symbol, not only records collective historical memory but also delivers the message of everlasting truth and the great fire of spirit.

Yet, language, especially the language that is broadcast through songs, i.e. lyrics, is an important expression of a spiritual culture of "willpower" and "sentiment". It is highly significant in the cultural identity of an ethnic group. The composition of music depends on shouts and screams. Yet, shouts and screams are sentiments and expressions that are natural, direct, and complete. They can shock people physically and instantly, people can't help having the feeling of sympathy. Even the most sensitive feelings in the whole nervous system like excitement, resonance, and a way out are all found in music. "Chuan Deng" is a common and popular song in the Malaysian Chinese community, appearing in different kinds of ceremonies and activities as a ceremony of cultural identity [55].

The song has turned into a beacon that inherits Chinese culture, brightening the soul and sense of belonging of all Chinese. A long river that has endless life, a common memory from history, the great wisdom of a nation, the excellent Chinese culture, and a good quality of heart and soul need this type of "Chuan Deng". Generally, the cultural psychology of humans is formed by four main elements, namely, willpower, language, religion, and sentiment. Lyric, as a kind of special language, can awaken a group's feelings and arouse great cultural identity [55]. Different nations have different historical and cultural backgrounds. Hence, songs of different styles are derived from different ethnic groups. It shows the original character of an ethnic group that is formed at an early stage. It also nakedly reveals the true feelings of the relationships between humans and nature, human and human as well as humans and society under the restriction of the materialistic environment. The song "Chuan Deng" consists of cultural characteristic that causes common feelings and therefore, it inspires the Chinese who have found their sense of belonging from generation to generation. The song retains and assimilates the genes and nutrients of traditional culture so that the Chinese can pass it on endlessly from generation to generation.

The process of cultural identity normally originates from the chasm of history or society. Before the 16th century, Chinese from China started trading in Nanyang, a few countries near the South China Sea, including the Malay Archipelago, the Republic of the Philippines, and Indonesia. However, they only started to settle down at these places approximately a hundred years ago. A great number of Chinese migrated to Malaya and settled down after the arrival of British colonists. Sadly, the British colonial government only treated Malays as natives. Most of the Chinese could not get their citizenship even after World War II, holding the status of immigrants [56]. Chinese, face different environments, climates, political cultures, social life, and religion. It was difficult for them to maintain their original lifestyle, they had no choice but to adjust their inner cultural mentality. They had to face the problems like, "Who am I?" "To survive, what type of attitude should I have?" etc. Being in the midst of drastic environmental changes, their hearts are full of uncertainty and anxiety, and this is when faith becomes a force

that provides them with spiritual support [57]. The Chinese need to know where they come from to form an identity and cultural identity [58].

The Chinese cultural identity became more obvious and the awareness of cultural consciousness began to grow stronger. When an ethnic group experiences various kind of adversities and disasters, certain symbols that have recorded the calamities can cause the ethnic group to work harder and have more self-confidence [59]. This inspires people to learn from their mistakes and become more mature. Those symbols that have recorded such adversities and disasters of an ethnic group should be preserved so that they can become part of the memory of the group. It has led to a higher level of ethnic cohesion and a stronger identification with the ethnic group [60] [61] [62].

The song "Chuan Deng" carries the heartfelt wishes of Malaysian Chinese and the sense of belonging of their souls, it is sung fervidly among Chinese throughout the world. First, "Chuan Deng" reflects a sense of cultural loss due to a lifestyle change that is challenged by different political systems and alien cultures and caused "cultural trauma" [63]. Second, it reveals the Chinese who had left their homeland and moved down South to Nanyang in the early days. After suffering hardships, they started reminiscing about their homeland and feeling ambivalent about their choice.

Third, the song shows that the connotation of Chinese traditional culture is eliminated and therefore, as a song, "Chuan Deng" is turned into a term and "symbolized". As a result, the Chinese turned the invisible psychological identity and sense of belonging into visible lyrics, this has become extremely significant in Malaysia Chinese's cultural identity. Although Singapore Chinese and Malaysia Chinese share common historical memories, they come across different historical experiences. After Singapore had been formed, the government crippled the Chinese language and Chinese education forcibly. Singapore's government tended to build up a "Western" nation. This is the reason why "Chuan Deng" only appeared for a short period in Singapore. However, I believe that the gene of Chinese culture can last forever as it has a strong life. Economic development can never clear the doubt about Singapore Chinese's cultural identity fundamentally. "Chuan Deng's soul" will spiritually become Singapore Chinese's sense of belonging. As a song and ceremony, the lyrics, melody, and meaning of "Chuan Deng" carry Malaysian Chinese historical memory and realistic mentality. It lets what had happened in the past, what is happening now, and what will happen in the future pause at a "historical" moment so that the Chinese community can create a common sentiment, finding a sense of belonging to their ethnic group; On the other hand, historical memory is what Chinese community currently treats it as a fundamental need, they restructure it to unite the people in the community. History is chosen and interpreted by the Chinese community, through particular influential circumstances, simultaneously they build specific outlooks and promote the cultural identity of the community.

3.3 The reason for the cultural identity of "Chuan Deng"

Identity is the origin of human significance and experience. As Calhoun pointed out without names, languages, and cultures, we would not know that there are humans. The differences between "oneself and others" and "we and they" exist due to names, languages, and cultures... self-awareness – No matter how one feels that self-awareness is discovered, it is still the result of construction – It will forever completely different from what others have specifically judged [64]. The process of music's cultural identity itself is a kind of "diverse construction" [65].

With the multicultural juxtaposition of world music education, music should be understood and dialogued not only as a work to be interpreted but as a culture in the process of construction [66]. "Diverse" can be comprehended by the differences between the music cultural characteristics of this kind of music and Malay music, as well as Indian music. The song "Chuan Deng"

involves emotions, body, spirit, and the various experiences of different senses; Chinese sing aloud the music experience and at the same time, relate the experience, historical memory as well as the emotional experience in reality.

These issues have directly shown that the basic point of music's cultural identity is human-centered, causing the Chinese to determine the process of identifying the questions "who", and "for whom" so that the symbolic content of the identity is determined. "The forming of history, the maintenance of society, the creation and experiences of oneself" are the background theories and specific cultural psychological field of the music cultural identity study. "Chuan Deng" was directly used by Malaysian Chinese during a particular period in history so that spiritually, they could find a sense of belonging which gave them spirit and strength. Though they were living in an era full of hardships and predicaments, they could still retain their excellent culture.

In terms of musical metaphor, Chinese music conveys cultural symbolic meaning. In "Chuan Deng", through a representation of the song (melody and lyrics) and the process of representation (passing the light on ceremony), during a particular period (in the 80s) and in a specific dimension (Chinese society), at a particular cultural field of an individual, society, and history, through the process of creating musical metaphor, the cultural symbol or significance of the song is specifically expressed. This causes the cultural identity function of "Chuan Deng" to be expressed integrally and authentically. As a kind of language and culture, "Chuan Deng" not only represents the world of Chinese's heartfelt wishes but spiritually, it becomes the Chinese's sense of belonging too. The cognitive emotion and practical significance that "Chuan Deng" contains are "expression" and "reappearance" in Chinese social life. Like language, it describes and at the same time, builds the Malaysian Chinese world and life.

Chinese characters are the important crystallization of Chinese civilization and the Chinese culture with a long and profound history. The lyrics of Chinese music are written by Chinese characters, which unite the common memory of Chinese people. In the lyrics of "Chuan Deng" "river" "mountain" "sea" "land" and "sun" imply the Chinese's common historical origin and memory. "Light" "incense" "long night" and "lighting gradually" implicitly show the suffering migratory journey and search for cultural roots.

"For life and consanguinity" and "every light has to burn itself" reflect the Chinese's determination to preserve their own culture in an indomitable way. In addition to "Chuan Deng", there is also classic Chinese music that is popular among the Malaysian Chinese- "Shanghai Bund". The opening line of "Shanghai Bund" begins with the words "Waves upon waves, for thousands of miles forever flew; washing the world and its view, in a murky current hitherto", highlighting the changes in Shanghai in the 1930s.

The lyrics are magnificent, using the waves and tides as a metaphor for success and setbacks, peaks and valleys, progress and loss in life. "Joy or sorrow, they don't tell which is false which is true; conquest or foil, they don't give even a clue" expresses the confusion of a young man with a heroic dream, struggling from the bottom to the so-called success. "Say I love you or hate you, like a river rushing thru", ostensibly refers to the love between Xu Wenqiang and Feng Chengcheng, but refers to the characters in the play in Shanghai wanting to serve their country in blood and the tender feelings and helplessness.

"Thousands of bends can't subdue, I haven't conquered the strife hereinto; there is joy, there is sorrow, even if I can't tell which's true; let hundreds of ebb and flow, beat me inside to the full", expressing the never-give-up spirit of the "underclass people" represented by Xu Wenqiang who want to realize their dreams through their struggle, and expressing the hard-to-let-go family and homeland feelings and the unique flavor of life to the fullest [67]. We know that cultural identity is based on the selective

memory of shared past and history, which is constructed through the common memory and culture of the community [68] [69], and the lyrics composed of Chinese characters have cultural connotation and vitality, which are deeply rooted in people's hearts and record the common memory of Chinese people.

"Shanghai Bund" is like a microcosm of the old Shanghai in the eyes of the Chinese. In the Republic of China, many Chinese went down South to Nanyang to make a living because of the war and other reasons, and although they were far away from home, they still did not forget their roots in Shanghai, no matter where they went, they were Chinese. Whether it is "Chuan Deng" or "Shanghai Bund", they are both Chinese music that carries the collective memory of Chinese people, and they are both the manifestation of Chinese people's identification with the Chinese national culture. Chinese music has become a comfort, a taste, a frame of memory and an eternal picture in the hearts of people. The lyrics are as follows:

Every river is a legend, from the mountain that is far away,
streams to the sea;
Every light is the incense derived from the same origin, lighting
the lengthy night gradually.
For the sake of the earth and grassland, the sun and the moon;
For the sake of life and consanguinity, life and consanguinity.
Every river is a legend;
Every light is the incense derived from the same origin;
Every river has to continue streaming;
Every light has to burn itself.

When the moon started showing up above the sea, the breeze blew gently and everyone got together to spend a memorable moment. The melody of "Chuan Deng" was heard from a distance. Faces of children carrying lanterns and white-haired seniors lighting candles came into sight. Gradually, more and more lanterns encircled the field. Slowly, through the melody of the song and the brightness of the lights, people started to have a stirring of emotion and were touched by their own long-lasting culture, like the sound of the river. Tears started rolling down their cheeks. Later, Xiao Man wrote the poem "Malaysia Chinese Fulfill the Origin of Culture" as follows: "Chuan Deng" is the sound of music and heartfelt wishes. It is not only persistence but one's expectation, confidence, and faith. It is a sound calling from nature in an era. In the sound of touching music, there is warmth from joyful waterfalls and heat from vital promises. Facing the sea and lighting the candles, the fire and water can rendezvous. Through handing down the song, people are predestined to have a common subject to interact with from generation to generation. Listening to "Chuan Deng" and singing the song, everyone's doubt is cleared. It brightens up one's responsibilities and hopes. Yes, every light is the incense derived from the same origin. Due to life and consanguinity, it has to burn itself and will never blow out. It illuminates people's hearts and warms the Chinese society. "Chuan Deng" tells us that the river of an ethnic group's culture must keep on flowing.

No matter which direction it is flowing to or it has to flow in the long night, there are still numerous lights bearing the responsibility adamantly and carrying out the mission of lighting the "incense" bravely. They have only one intention, that is, to continue passing on and inherit "life and consanguinity" from one generation to another. To retain the root of our life that keeps on growing, every light must have the determination to burn itself.

In an environment rich in a melodious voice, let us pray wholeheartedly: We anticipate that numerous streams will flow to the sea and integrate with the seawater. Endless time and days stop at this present moment, the notions of virtue and righteousness left by our ancestors are transfused into our warm blood and become inexhaustible strength. Under the candles that brighten up one another, the radiance of Chinese culture throughout the ages reappears. From that day on, the song "Chuan Deng" is sung loudly in every corner of Malaysia and it has been sung until today. It has become the theme song of

Chinese cultural activities and gatherings of Chinese associations. In the "light-passing ceremony" during the Mid-Autumn Festival every year, while listening to the song, elders who attend the ceremony use their left hands to cover the lighted candles held in their right hands carefully. Then, they slowly pass their candles to their children. Having this kind of mentality, Malaysian Chinese are always careful at all times, yet they never let the candles in their hands blow out. The song "Chuan Deng" has transformed into a beacon, inheriting the fine Chinese traditional culture and it is embedded in the Malaysian Chinese's deep heart core. It kindles the countless lights in the Chinese descendants' hearts.

Chinese people. We can see that the Chinese's "like thinking" pattern which is reflected by Chinese characters constructs the whole thinking system of the ethnic group. Other languages in this world do not possess the great charm that the Chinese language has.

4 Conclusion

The culture of an ethnic group is the nutrients for the group to survive and progress, the loss of the inherent culture causes one to lose the spiritual nutrients that he needs to survive. Chinese excellent traditional culture is a rich historical heritage inherited from our ancestors [70] [71], a cultural essence and consensus of values condensed by the interchange and intermingling of various ethnic groups during their long historical development [72], fully embodying the Chinese national genes [73] [74], and nourishing Chinese civilization through the millennia [75].

In the economic globalization era, the Chinese should preserve their own culture. Chinese culture can be inherited from generation to generation showing that it has a nature of great tolerance therefore, Chinese culture can exist symbiotically and harmoniously with other cultures under multi-cultural backgrounds nowadays, sharing prosperity. Ultimately, the various cultures will share a common and beautiful world. Characters are the genes of culture. Different types of characters reflect different kinds of ethnic groups' cultures. The appearance of characters is one of the most important signs of the birth of civilization [76]. Chinese character is one of the characters that have been used for the longest time, the widest space, and the largest number of people in the world [77].

It is a kind of spiritual civilization and the initial stage of human civilization [78]. There are moral values and etiquette in Chinese characters. Then, shapes of the characters that have different conceptions were created [79]. Subsequently, pronunciations and meanings came into pictures, and the concatenation of things and events in the universe dwell amid Chinese characters. Chinese characters were built under the fundamental Asian text icon symbols (the most fundamental abstract to the constitution of all creation on earth), corresponding with the structural schema of all creation in the universe. Chinese characters are the second abstract to all creation in nature and contain Chinese's extreme pictogram nature of thinking patterns. They consist of the trait of integration between intuitive thinking and rational thinking. Chinese characters are a small universe, carrying enormous philosophy and cultural connotations. They are different from other alphabetical phonetic writing as not only do they have pronunciations but also meanings of their own, causing time and dimension to cohere. The dimensional function of Chinese characters reveals the "close and peaceful" relationships among nature, society, and people.

They represent the Chinese who are full of emotional and sentimental experiences. Chinese characters also accommodate a rational spirit that is solid. The unique thinking pattern that is formed by the Chinese language has deeply influenced Chinese in every corner of the world. For instance, the art of tea drinking consists of the good qualities of value and respect for etiquette, Chinese herbs are consumed to prevent sickness and the Chinese believe in eating and drinking culture to recuperate as there are therapeutic properties in food. There is uniqueness in architectural culture as the Chinese adapt the notion of nature

and human syncretism. All these have become a kind of cultural gene, influencing every Chinese. Malaysian Chinese once went through hardships for a period of more than a hundred years. They had to face long-term arduous and tortuous struggles with British colonists [80] [81] [82], Japanese invaders, and the implementation of the country's sole education policy [83], only then they could preserve the 1293 Chinese primary schools, 60 Chinese independent schools and 3 multi-media Chinese higher education colleges [84].

The "River of Culture" could only be preserved after so many constant and unyielding struggles from the heroes who had fought for Chinese education. Throughout the thorny and difficult historical process, Malaysian Chinese sages have always sung Chinese music, which is full of Chinese cultural nutrients and have always held on to the Chinese national culture.

The lyrics and melodies of Chinese music can make Malaysian Chinese find spiritual belonging and cultural identity, and Chinese music has deeply imprinted Chinese national culture in the hearts of Malaysian Chinese. According to Manuel Castells, an American sociologist, "The age of globalization is also the age of nationalist revival, both in terms of challenges to the existing national and in the construction and reconstruction of identities based on nationhood that exist everywhere and ethnicity that always claim to oppose outsiders" [50].

There are problems like uncertainties in education objectives and utilitarianism in Malaysian Chinese education nowadays. Chinese syllabuses are simplified and therefore, cause the quality of Chinese education to drop. In the long run, the consequences will be unimaginable. Language is the tool of thinking and the gene of culture. Among the Chinese students, although many of them can speak the Malay language, English language, and Chinese language, their thinking is fragmentary. Under many circumstances, there is an interference of other languages while acquiring one language and hence, confusing their thinking.

Chinese language, English language, and Malay languages belong to Sino-Tibetan, Indo-European, and South Island respectively which are three different types of language systems. The origins of the languages are different and therefore, form different thinking patterns. Language learning is not only constrained to communicative purpose but most importantly, it is to form a thinking pattern that is suitable for an ethnic group's specification and thus, adapting to the environment better. Xushen from the Eastern Han dynasty claimed that Chinese characters are fundamental to Confucian classics and the initiation of rulers, thus our predecessors created history and the descendants learn the history.

The ancients said, "When morality is instilled, Tao comes into being, human beings do not get confused after they have approached Tao" [85]. It can be said that Malaysia is the only country other than China that has a complete Chinese language education system, and the development of Chinese language education in Malaysia is closely related to Malaysia's racial policy, although the Malaysian government has stated that it respects the political reality of a pluralistic society and gives space for the Chinese community to develop education [86], there is always a discrepancy between theoretical equality and factual equality in a multi-ethnic society.

In a country where the dominant ethnic group is the majority of the country's population, the dominant ethnic group will naturally be given the status of a core nationality and the interests of other ethnic groups may not be accommodated. In such a complex situation, it is all the more important for overseas Chinese to unite and make full use of the cultural identity function of Chinese music, to comprehend the cultural meaning and national cohesion contained and conveyed by Chinese music, and to let more Chinese music become a beacon like "Chuan Deng", to pass on the spiritual fire of the Chinese nation and to integrate the essence of traditional culture into our bloodline.

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ETHICAL DIMENSION OF ACCOUNTING

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Abstract: The paper analyses the current Czech methodology of accounting for experimental animals and animals sold as pets at retail pet stores while assessing whether the methodology is in line with ethical principles, as pets sold at retail are treated as goods in the accounts and experimental animals are accounted for as material. The paper proposes procedures for accounting for experimental animals and animals sold at retail.

Keywords: ethics, chart of accounts, accounting for experimental animals, accounting for animals at retail.

1 Introduction

Although it might seem that accounting and ethics have nothing in common, this is not true. The importance of ethics in accounting has been growing after several accounting scandals that took place at the turn of the century (Poje & Zaman Groff, 2023). The increasing importance of ethical behaviour in accounting is confirmed by the extensive literature review of Poje & Zaman Groff (2022), who present a growing number of papers published on this issue, as well as a growing number of research subareas. However, there are currently only a small number of accounting papers dealing with the nexus of animals, accountability, ethics, and power (Vinnari et al., 2022). There are still areas where the interlinking of these disciplines can be improved.

In general, the main purpose of accounting is to provide information applicable in making economic decisions (Sedláček, 2010; practical application Hašková & Fiala, 2022). It reflects society, expressing the principles and requirements of the social system, and recording its economic processes. Corporate accounting and budgeting in the Czechoslovak Socialistic Republic before the year 1990 was, as in other "Eastern Bloc" countries, fully and obligatorily unified by legislation (Jaruga, 1990). This was achieved through a unified system of accounts, a detailed accounting methodology, and a unified system of accounting reports, which primarily served the needs of the central authorities (Schroll, 1995). A true and fair view was introduced and reported in Czech accounting in the 1990s, following the changes in 1989 (Zárybnická & Žárová, 2022). This was associated with a greater emphasis on ethics in accounting and on adherence to its principles. A significant societal change in the first decade of the 21st century was also the decision on the admission of the CR to the European Union in 2004 and the resulting process of aligning the system of accounting regulation in the CR with EU legislation (Wagner et al., 2019). In many respects, society has made progress in the field of ethical principles, and this should be reflected in accounting as well.

In the Czech Republic, accounting as a profession is not formally regulated. However, there are professional accounting examinations at various levels for professional accountants, auditors, and tax advisors (Kubíčková & Jindřichovská, 2020). The function of accountants in the economic system depends on their ability to maintain the perception of high ethical standards (Caglio & Cameran, 2017). Accounting in the Czech Republic is regulated by a number of legal norms, particularly by Act No. 563/1991 Coll., on Accounting, and the Czech Accounting Standards, which differ slightly from the International Financial Reporting Standards.

Ethics is a philosophical discipline dealing with the moral dimension of reality (in terms of practical application, this is

addressed, e.g., by Hašková (2017) or Maroušek et al. (2016)). Due to the sensitivity of data concerning corporate finance, accountants and auditors are required to study accounting ethics, as it is an essential aspect of the preparation of financial statements. In general, the term "ethics" refers to morality or a code that determines criteria for distinguishing between what is right and wrong (Banerjee & Ercetin, 2014). Here, ethics is a prerequisite for the smooth functioning of the accounting system. Recipients of financial statements expect information included in the financial statements to accurately reflect the economic reality, be reliable, accurate, prospective, and clear (Biadacz & Borowiec, 2017).

Nevertheless, there is another dimension that cannot be enforced by any legislation. It is respect for specific moral values, where there is legally enforceable, faithful, and honest accounting supported by reliable and proper accounting documents on one side, and other values that accounting does not reflect on the other side. An example could be accounting for experimental animals. Using animals in scientific experiments still attracts significant controversy (Hobson-West, 2012). Animal ethics is a significant extension of contemporary applied ethics, and its development now faces major challenges both in terms of theoretical background and social practice (Shih, 2022). Although thanks to advances in science, technology, and bioinformatics, there are new tools available that reduce the need for laboratory animals, those are still being used (Claude, 2009).

The objective of the paper was to examine whether the current Czech accounting reflects generally valid ethical principles. In order to achieve this objective, the authors try to answer the question of whether the methodology currently regulating accounting for experimental animals and animals sold at retail in the Czech Republic adheres to ethical principles.

2 Ethics in accounting – literature review

Ethical principles and responsible business should be an inseparable part of every industry and field, including accounting. Certain parallels can be found between accounting and ethics (Dolfsma, 2006). This is confirmed by Aifuwa et al. (2018), who, based on the analysis of questionnaires, found that there is a significant relationship between accounting ethics and the quality of financial reporting. The importance of ethics in accounting increased significantly after the corporate scandals at the turn of the century. These scandals mirrored a serious lack of ethics in financial reporting as well as in accountability to the general public (Poje & Groff, 2022). Unethical behaviour in accounting is often also due to the rapid evolution of technologies and increasingly more integrated nature of accounting information systems in business (Guragai et al., 2014). However, people may be unaware of their unethical behaviour. In their multi-stage theory of ethical accounting, Kim et al. (2021) describe how differential access to information may create an interrelated series of cognitive distortions in how people feel responsible for the same unethical behaviour. This model builds on the assumption that such distortions can make people consider themselves to be fair and consistent when in fact they are not.

The Code of Ethics plays an important role in addressing this problem, as it leads to a unification and awareness of ethical and moral rules. This results in reducing corruption, fraud, and unethical behaviour (Rogošic & Perica, 2023). According to the members of the International Federation of Accountants (IFAC), there are many serious ethical risks. These include failure to maintain objectivity and independence, improper leadership and poor organizational culture, lack of ethical courage and ethical sensitivity, as well as failure to exercise proper professional judgment. These problems occur also in the non-governmental and governmental sectors. Companies need to cooperate also with accounting academics to improve ethical knowledge. Appropriate ethics education should be included in the

accounting curriculum so that future accountants learn to critically consider possible consequences before making decisions with ethical implications (Jackling et al., 2007). This is also confirmed by Low et al. (2008), whose survey found that even accounting students perceive ethics education as an important factor influencing their ethical behaviour and believe it should be included in the study programme. Accounting ethics education is outlined by Uysal (2010) in a comprehensive bibliometric analysis of business ethics with a focus on accounting as one of three areas that have emerged in the literature on accounting ethics, along with moral cognitive development and implications of ethical decision-making models. A similar topic is addressed also by Armstrong (1993), who concludes that further moral development of students requires including ethics in curricula.

Recently, there have been many new demands and regulations that have reignited the discussion on ethics in animal research. Many ethical issues and problems arise in this field, which also concerns accounting (Gross & Tolba, 2015). Although animal-based experiments are criticized by the public, scientists involved in animal experimentation tend to defend their practices and refer to other scientists, farmers, and pet owners. This approach is negatively reflected in the relationship between science and the public (Michael & Birke, 1994). The number of animals used in research has grown with the advancement of research and development in medicine. Every year, millions of experimental animals are used globally. Besides the ethical aspect of this issue, there are several other negatives of animal experimentation, such as the requirement for qualified workers, time-consuming reports, complex accounting, and high costs (Doke & Dhawale, 2015). In contrast, Claude (2009) states that scientific and technological advances and advances in bioinformatics have provided new tools that enable reducing the need for laboratory animals, although they are not capable of replacing them completely. The use of animals for cosmetics testing has already been prohibited in the EU. Lewejohan et al. (2020) conclude that from the point of view of animal well-being, it is necessary to improve their living conditions outside the experiment. Folescu et al. (2013) deal with a new strategy based on alternative methods that replace laboratory animals with modern techniques. However, the defenders of animal experimentation argue that it is not possible to completely eliminate animal experimentation as long as the benefits to humans are of great importance.

According to Kouřilová & Drábková (2012), the society's view of animals has changed dramatically in recent years. Czech law long considered animals to be things. This improved when the new Civil Code came into force, as the new Civil Code views animals as living creatures. However, in accounting, they are still considered as stock or tangible fixed assets. In contrast, according to the International Financial Reporting Standards, no biological assets can be included in stocks, nor they are considered inventories. They are subject to a separate standard, IAS 41 – Agriculture (Dvořáková, 2011).

There are many other differences between the Czech accounting regulations (MFČR, 2023) and the International Financial Reporting Standards (IFRS (2023), which are gradually erased by Czech experts in cooperation with legislators. The accounting system according to Czech law and both internationally recognised accounting systems are based on different fundamental requirements; therefore, the perception and accounting for animals in the Czech Republic and elsewhere in the world can differ as well.

Hinke et al. (2007) state that accounting according to Czech legal norms is regulated in the opposite direction than the world accounting standards. The accounting legislation of the Czech Republic primarily determines the methods, defines the correlations, and presents the chart of accounts based on which individual transactions are to be accounted for. Hines (2007) argues that International Financial Reporting Standards are becoming increasingly important in the global economy. In recent years, there has been pressure to adopt a unified set of

financial accounting standards to replace the myriad of standards specific to individual countries that are currently still in use. According to Abdul-Baki & Haniffa (2019), the effectiveness of International Financial Reporting Standards primarily depends on the enforcement of accounting standards in a given country. Sucher & Jindřichovská (2011) deal with the implementation of International Financial Reporting Standards in the Czech Republic. Based on a review of legislation, institutional framework, and conducted interviews, the authors point out problems that are related to the differences and implementation of internationally recognised accounting systems. Žárová and Mejzlík (2009) believe that the aim of the Ministry of Finance is to implement some of the globally recognised accounting practices into Czech accounting standards. However, this effort often brings very complicated situations and may cause the collapse of the accounting system. Jindřichovská and Kubičková (2017) argue that the implementation of IFRS elements into Czech accounting standards is only partial now; therefore, the ethical approach to accounting may differ compared to countries that use international recognised accounting systems.

3 Methodology

First, it is necessary to define the legal framework for the use of experimental animals in the Czech Republic (CR) and the term “experimental animal”. Next, there will be presented an overview of selected species and heads of experimental animals that were used for experiments in the Czech Republic in 2021. Moreover, a procedural analysis of the current Czech methodology for accounting for animals – Decree 500/2002 Coll., Section 9, will be performed in order to analyse the prescribed accounts and accounting procedures stipulated in this area by the Czech Accounting Standards – Czech Accounting Standard No. 015 – Inventories. There will be analysed the negative effects of the current approach to experimental animals, as well as the ethical dimension of the current accounting for experimental animals. The output should be a proposal of new accounts that would be appropriate to include in the guideline chart of accounts for the accounting for experimental animals and animals sold as pets at retail, and account assignments for selected accounting cases will be proposed.

4 Results

In the Czech Republic, animal protection is mainly the responsibility of the Ministry of Agriculture and the State Veterinary Administration of the Czech Republic. The Ministry of Agriculture approves the statute and rules of procedure of the Central Commission for Animal Protection and the Committee for Protection of Animals used for scientific purposes. Moreover, it carries out tasks arising directly from the regulations of the European Union on the protection of animals against cruelty, keeps central records of the number of experimental animals used, grants and withdraws authorisation for the keeping, supply, and use of experimental animals.

The Committee for Protection of Animals used for scientific purposes provides consultancy on the acquisition, breeding, housing, care, and use of experimental animals. It ensures the sharing of best practices.

Committees for protection of animals used for scientific purposes of the EU Member States exchange information about the functioning of expert committees and on the conduct of the evaluation of experiments and share best practices. The purpose of information exchange is to prevent the repetition of the same experiments in the EU countries. The State Veterinary Administration establishes veterinary conditions for the conduct of animal experiments and based on the results of inspections, it may issue a decision on a binding instruction to remedy the deficiencies identified.

The definition of an experimental animal in accordance with Section 3 j) of the Act No. 246/1992 Coll., on the protection of animals against cruelty states that “experimental animal” is:

1. A living vertebrate animal that is or is to be used for experiments, except for human beings, but including self-feeding larval forms and mammalian foetus from the last third of their normal development, or
2. A living cephalopod that is or is to be used for experiments; an experimental animal is also an animal that is at an earlier stage of its development than the stage specified in point 1 if it is to be allowed to live beyond that stage of development and is likely to experience pain, suffering, distress, or lasting harm as a result of the experiments carried out when it reaches that stage of development.

Under this Act, experiment means any invasive or non-invasive use of an animal for experimental or any other scientific purposes with a known or unknown outcome or use of an animal for educational purposes that is likely to cause pain, suffering, distress, or lasting harm to the animal of at least the intensity of the introduction of a needle according to the normal veterinary practice. Experimentation also refers to any course of action that has or may result in the birth or hatching of an animal or the creation and maintenance of a genetically modified animal line in any such condition. The killing of an animal solely for the purposes of using its organs or tissues shall not be considered experimentation.

The provisions of this Act governing the protection of experimental animals do not apply to cases where experimental animals are used for the following purposes:

- a) Non-experimental agricultural practices,
- b) Non-experimental clinical veterinary practices,
- c) Veterinary clinical trials required for the marketing authorisation of a veterinary medical product,
- d) Practices carried out for the purposes of recognised animal husbandry practices,
- e) Practices carried out for the purposes of animal identification,
- f) Practices not likely to cause pain, suffering, distress, or lasting harm caused by the introduction of a needle in accordance with the normal veterinary practice.

Tables 1 and 2 in the Appendix present data from the Czech Republic for the year 2021 concerning the use of selected animal species for experimentation and the number of heads of animals used for experimentation by the purpose of experiment.

The attitude to animals is reflected in the method of accounting for them. From an accounting point of view, livestock in the Czech Republic are divided into fixed tangible assets and current assets.

Breeding animals, such as cattle, horses, pigs, sheep, goats, flocks of breeding geese, racehorses, sport horses, and draft animals are accounted for in the category of tangible fixed assets, balance sheet asset account 026 – adult animals and their groups. At the discretion of the accounting unit, there can be included also herds of other farm animals, e.g., mouflons, fallow deer, red deer, or ostriches.

Valuation represents one of the most important elements of accounting. The valuation method significantly influences the amount of the reported profit or loss and the transparency of financial statements. The valuation of acquired fixed assets in the CR is based on Decree No. 500/2002 Coll., which, unlike IFRS, presents an exemplary list of items to be included in the acquisition costs rather than a general rule. Most of these items comply with the general rule stipulated by IFRS.

Czech Accounting Standard for Entrepreneurs no. 013 Fixed tangible and intangible assets state that depreciation of adult animals and their groups can be applied by expressing depreciation as a proportion of the acquisition price less the expected revenue at culling (numerator) and the expected number of years in breeding (denominator). Draft animals, racehorses, and breeding horses are depreciated individually,

other adult animals and their groups can be depreciated in groups. In the case of these categories of animals, technical evaluation is not included.

Young animals, slaughter animals, flocks of hens, ducks, turkeys, guinea fowl, fish, bee colonies, and fur skin animals are included in the category of current assets, balance sheet asset account 124 – young and other animals and their groups. According to the accounting standard no. 015 – Inventories are reported at cost; raised breeding animals at cost or at replacement cost if cost cannot be determined. Newborn animals are reported at cost in account 124 – Young and other animals and their groups in conjunction with the account in group 58x – Change in inventories of own activity and their capitalization.

However, experimental animals are not accounted for in account 124, as in accounting, they are considered material, account 112 – material inventory. It is recommended to distinguish these animals through analytics for account 112 (Decree No. 500/2002 Coll., Section 9).

As for accounting for the sale of animals classified as current assets and recorded in account 124 – Young and other animals and their groups, account 311 – Customers is used in conjunction with income account 601 – Sales of own products.

Retail outlets account for animals they sell as goods. Decree No. 500/2002 Coll, Section 9 defines that animals acquired for the purpose of sale are considered goods if the entity trades in such animals. Retail outlets therefore account for animals sold as pets using either method a in account 132 – Goods or method b in account 504 – Goods sold. The revenues are accounted for in revenue account 604 – Sales of goods.

As in the case of any other assets, it is necessary to take inventory of animals as well. Section 29 of the Act No. 563/1991 Coll., on Accounting, instructs accounting units to determine the actual state of assets and liabilities by taking inventory. This is carried out at the time when the financial statements are drawn up. Accounting units are obliged to prove that inventory was carried out for a period of 5 years after inventory. For each type of asset, inventory-taking must be performed at least once in each accounting period.

In the physical inventory of foundation herd and draft animals, it is appropriate to proceed by taking an individual inventory of adult beef cattle, draft animals, brood sows and boards, and animals with breeding value and other animals. In the case of animals included in stock, the inventory is taken based on inventory numbers or other characteristics. The results are always recorded in the inventory lists.

According to the authors, the current Czech accounting methodology is proof of cynicism, indifference, contempt for creatures without which our medicines, medical procedures, cleaning products, cosmetics etc. would not exist. Experimental animals, to which we owe our progress and comfort are recorded as inanimate things that do not feel fear or pain. People in general are not educated to respect animals (Feinberg, 2017). Considering an animal as a material or commodity means denying them the right to feel fear, pain, or joy (Singer, 2016).

The authors thus believe that the chart of accounts should be extended to include new accounts that would be used to account for experimental animals and animals sold at retail. Obviously, this change will probably not solve the ethical problems but is at least a small step towards correction from the side of accounting bodies and food for thought.

According to the authors' proposal, experimental animals would continue to be accounted for as inventories but a separate balance sheet asset account (account 125 – Experimental animals) would be created for them. The death of an experimental animal would be reported in a separate expense account 503 – Death of experimental animal. Animals purchased for retail sale could have a separate balance sheet asset account

126 – Animals at retail. The sale of an experimental animal or animal at retail would be reported as an expense in account 547 – experimental animal sold and animal at retail sold when removing the animal from inventory. Proceeds from the sale of a young, slaughter, experimental animal or animal at retail could be reported as income in account 603 – Proceeds from animal sold – current assets. The change in the stock of animals – current assets – is currently illogically accounted for alongside expense accounts in group 58 – Change in inventories of own activity and capitalization. The authors propose that experimental animals could be accounted for in account 587 – Change in experimental animals.

If method b was used to account for the purchase of experimental animals and animals at retail, in the case of experimental animals, it would be appropriate to establish a new expense account 505 – Experimental animals, while in the case of animals at retail, expense account 506 – Animals at retail.

Appendix I provides a summary table (Table 3) with the proposed account assignment. The authors believe that extending the indicative chart of accounts would not be burdensome for accounting units. Moreover, it would certainly declare respect for living creatures. The requirement to provide a true and fair view of financial statements would not be influenced by this change; in contrast, balance sheets and profit and loss accounts would provide more accurate information.

5 Discussion of results

The authors found that according to the current Czech methodology, animals are accounted for as a fixed tangible asset or current asset.

Young animals, slaughter animals, flocks of hens, ducks, turkeys, guinea fowl, fish, bee colonies, and fur skin animals are considered current assets. In account for these animals, balance sheet asset account 124 – Young and other animals and their groups are used. However, experimental animals are accounted for in balance sheet asset account 112 – material inventory. It is quite unethical to refer to living creatures as material, inanimate things. Animals sold at retail as pets are accounted for using method a in account 132 – Goods, or using method b, account 504 – Goods sold.

As for the ethical dimension of accounting, the authors conclude that the current Czech methodology for accounting for experimental animals and animals at retail is not in line with ethical principles.

For this reason, new accounts and related account assignments are proposed to be used to account for experimental animals and animals sold at retail. The extension of the chart of accounts with these new accounts would express respect for living creatures and would not be burdensome for accounting units.

The proposed accounts are specified below:

- Balance sheet asset account 125 – Experimental animals
- Balance sheet asset account 126 – Animals at retail
- Profit and loss expense account 503 – Death of an experimental animal
- Profit and loss expense account 547 – Experimental animal and animal at retail sold
- Profit and loss expense account 587 – Change in experimental animals
- Profit and loss income account 603 – proceeds from the sale of an animal reported as a current asset
- Profit and loss expense account 505 – Experimental animals (purchase of experimental animal, method b)
- Profit and loss expense account 506 – Animals at retail (purchase of animals intended for retail sale, method b)

Obviously, this change in accounting would not change the situation of experimental animals. However, it would express the

respect of society for living creatures without which the health of the population, the well-being and comfort of our civilisation would be threatened or not exist.

6 Conclusion

The objective of the paper was to analyse whether the current Czech methodology for accounting for experimental animals and animals sold at retail is consistent with ethical principles. It was found that this methodology is not ethical.

Animals sold at retail as pets are currently accounted for as goods. The paper recommends including new accounts in the chart of accounts that could be used in this case.

Experimental animals, to which we owe the advances in medicine, are accounted for as materials. The paper suggests new accounts to be included in the chart of accounts for the purpose of accounting for this type of animals.

When selling animals recorded as current assets, profit and loss income account 601 – Sales of own products is currently used. The authors suggest including a new income account in the chart of accounts that would replace account 601 and reflect the nature of these assets.

The paper proposed account assignments for selected accounting operations using the proposed accounts.

The extension of the chart of accounts and the revised methodology for accounting for experimental animals and animals sold at retail would not be burdensome for accounting units. Moreover, it would be an expression of our awareness of the debt we have to experimental animals and society's attitude towards living creatures in general.

Appendix

Tab. 1: Overview of selected animal species and their use for experimental purposes in the Czech Republic in 2021

Species	Number of heads
Laboratory mouse	74 989
Guinea pig	1 999
Laboratory rat	17 375
Domestic rabbit	5 038
Domestic pig	1 619
Cattle	2 305
Domestic cat	115
Domestic dog	377
Chicken	22 033
Livebearers	74 305
Other fish species	30 185

Source: MZE (2022).

Tab. 2: Number of heads of animals used for experiments in the Czech Republic in 2021

By purpose of experiment	Number of heads
Fundamental research	78 953
Transplantation and applied research	32 008
Legislative purposes and production	36 128
Environmental protection for the purpose of protecting human or animal health or welfare	93 038

Source: MZE (2022).

Tab. 3: Accounting for experimental animals and animals at retail

Economic operation	Account assignment
Purchase of experimental animal – Method a	125/ 321
Death of experimental animal	503/125
Sale of experimental animal – removal	547/125

Sale of experimental, young, or slaughter animal – invoicing	311/603
Newborn experimental animals – raised breeding	125/587
Purchase of animal intended for sale at retail – Method a	126/321
Sale of animal at retail – removal	547/126
Sale of animal at retail – cash sales	211/603

Source: Authors.

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Primary Paper Section: A

Secondary Paper Section: AH

MOTIVATING AND REWARDING EMPLOYEES IN CONSTRUCTION ENGINEERING SMEs

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This paper is a partial output of the project of Institute of Technology and Business in České Budějovice "IVSUPS2303 - Identification of elements of ethical management and CSR in SMEs".

Abstract: The article evaluates motivation and reward systems in small and medium-sized enterprises in the Czech construction engineering sector. The research sample involved four companies comprising 53 employees. Our findings showed that firms use various motivation tools stretching over all four quadrants, indicating the worst results in education and development. The employees still mostly appreciate monetary rewards and feel motivated by the company. The reward scheme is different through regions and national salary levels. What strengthens motivation is effective interpersonal communication between managers and workers, focusing on motives and benefits of the least weighted scaling.

Keywords: Human Resource Management; SMEs, Motivation of Employees, Motivation System, Motivation in Construction Engineering, Rewarding Employees, Salaries in Construction Engineering

1 Introduction

Employees are integral to any company and its production process, creating corporate know-how. Developing staff skills and knowledge is natural and essential in modern and effective human resource management (Sitnikov, et al., 2021). Its managers must wisely use relevant tools for people's and the company's profit. Effective human resource management lead to increased performance and personal satisfaction. Rewarding and motivation systems, including, yet not limited to, various benefits, are vital to keeping employees satisfied. Corporate ambitions must, above all, boost manufacturing productivity (Kuznetsova, et al., 2019). Construction engineering is not an exception, coping with turbulent market conditions, escalating costs, energy crisis, exorbitant material prices or scarcity. A lack of corporate funds cannot meet the financial requirements of current employees and may dissuade potential recruits. What also matters is the business size in the Czech construction engineering sector (Paulišová & Hanák, 2018). Specific conditions of small and medium-sized construction engineering enterprises give grounds for exploring reward and motivation systems.

2 Theoretical backgrounds

Rewarding and motivating employees is the bread and butter of highly dynamic human resource management (Sitnikov, et al., 2021), continuously considering and addressing staff needs (Lobos, et al., 2020). Although effective communication is integral for high motivation (Kamal, et al., 2022; Shakeri & Khalilzadeh, 2020), the construction engineering sector falls at the first hurdle (Camngca, et al., 2022). Al Qaydi & Aris (2021) argue that the human resource department should primarily focus on training, developing and rewarding employees, working environment and maintaining an ethical performance atmosphere. The organizational culture may involve other incentives like fighting for a better position in the labour market (Klimecka-Tatar & Niciejewska, 2021). Knowledge of sustainability, environmental protection, and Industry 4.0 also goes a long way (Bonilla, Ribeiro and Gomes, 2022), pointing to the links between human capital and the labour market (Brožek, et al., 2022). The construction engineering sector is the largest global polluter, producing 25-33% of the EU waste (Murtagh, et al., 2020). The industry should reduce costs and emissions (Asah-Kissiedu, et al., 2021).

Human resource management in small companies suffers from a lack of field experts (Atkinson, et al., 2022) and a failure to

follow prescribed rules and procedures (Caha & Urban, 2020). Adhering to the established agenda would boost competitiveness (Elrehaila, et al., 2020) and job satisfaction (Heimerl, et al., 2020; Zhang, et al., 2020), productivity (Koneru, 2019) and performance (Akbiyikli, et al., 2023), reflected in job security (Medina, et al., 2022) and in-house bonuses (Manzoor, et al., 2021). Staff productivity in the construction sector is critical because of slow work performance (Maqsoom, et al., 2022), incompetent workforce (Wong, et al., 2020), minimum wage (Hitka, et al., 2021) and low salary (Smolarek & Sulkowski, 2020), wage deficiency (Aghayeva & Slusarczyk, 2019), mental distress and low motivation (Bukhari, et al., 2021; Van Tam, et al., 2022).

A failure also encourages employees as they have something to learn from (Lin, et al., 2022). Education is also integral, where uneducated workers are sensitive to the corporate image (Vavra, et al., 2020), improved by staff loyalty (Nadeak & Naibaho, 2020). Nguyena, et al. (2020) claim that education is not statistically significant for corporate faithfulness. Developed knowledge and training help workers assert, engage and make decisions (Pincus, 2022). Staff motivation also depends on goals, attributes and conditions employees want to set out (Bugdol & Jedynak, 2022).

Modern employees require high work-life standards, huge rewards and employee welfare (Yee, et al., 2020). Financial and non-financial rewarding affects motivation and work performance (Matloob, et al., 2021), pushing employers to raise wages far beyond limits prescribed by the law (Marin-Garcia & Martínez-Tomás, 2022; Walczak, 2019) to avoid labour turnover (Hassan, 2022). Salary levels depend on many factors (Postek & Poswiata, 2021), including wage competitiveness, healthy working environment (Anguelov, et al., 2020), personal satisfaction (Jankelová et al., 2020) and attracting recruits (Bussin & Mouton, 2019). Rewarding must also be fair, transparent and free of bias (Stareček, et al., 2021). Although managers can use many reward models (Perekarenkova & Kryshka, 2019), like WorldatWork (Bussin & Brigman, 2019), they should prioritize psychological and social aspects over wages, bonuses and benefits (González, et al., 2022). Wage levels also reflect productivity, labour market conditions and related turnovers to better-paid and more prestigious sectors (Kuznetsova, et al., 2019). Updated, fair and unbiased job perks (Laundon, et al., 2019) are also integral for increasing motivation and reducing labour turnover (Černá & Němec, 2019).

3 Research aims, data and methods

The article aims at evaluating how small and medium-sized companies in the construction engineering sector motivate and reward employees. We formulated the following research questions:

- RQ1: What are reward and motivation systems in SMEs in the construction sector?
- RQ2: What employers want to change to make reward and motivation systems more effective?
- RQ3: How are employees satisfied with reward and motivation systems?
- RQ4: What are the differences in reward and motivation systems in SMEs in the construction engineering sector throughout regions?

We used a semi-structured interview including 11 questions with four employers of small construction companies, sending a questionnaire of 17 items to 53 employees and closely observing one firm. The companies operate in different geographical segments throughout the Czech Republic. We inspected in-house materials, including statements on wages from the CZ-NACE database of economic activities. Mathematical-statistical methods allowed us to compare the data using descriptive

statistics. A Likert scale suggested inquiries comprising a contingency table. All aspects included extent and weight input into WorldatWork modified quadrant.

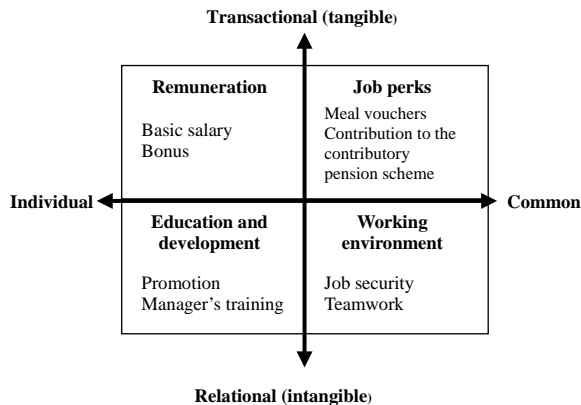


Figure 1: Motivation system quadrants
Source: Author's elaboration according to Armstrong

4 Results and discussion

This chapter suggests and discusses our results.

4.1 Reward and motivation systems in SMEs in the construction engineering sector

Motivation systems observe the quadrant in Fig. 1, including staff motivation aspects. Table 1 depicts individual inducements inquired about in the interview. Red marks untapped stimuli, whereas green refers to widely used incentives.

Table 1: Motivation aspects from the quadrants as used by the companies

Stimulus	Company A	Company B	Company C	Company D
Basic salary	Green	Red	Red	Red
Pay rise	Green	Red	Red	Red
Bonuses	Green	Red	Red	Red
Wages performance components	Green	Red	Red	Red
Manager-assigned education	Green	Red	Red	Red
Education at one's own needs	Green	Red	Red	Red
Personal development	Green	Red	Red	Red
Promotion	Green	Red	Red	Red
Active pursuit for further education	Green	Red	Red	Red
In-house education	Green	Red	Red	Red
Flexibility	Green	Red	Red	Red
Contribution to the contributory pension scheme	Green	Red	Red	Red
Holiday contribution	Green	Red	Red	Red
Use of the firm's facilities for private purposes (mobile phone, laptop, car...etc.)	Green	Red	Red	Red
Meal vouchers	Green	Red	Red	Red
Workplace free-of charge-refreshment	Green	Red	Red	Red
Cafeteria (flexible benefits)	Green	Red	Red	Red
Transport to work	Green	Red	Red	Red
Clothing contributions	Green	Red	Red	Red
Other benefits	Green	Red	Red	Red
Job security	Green	Red	Red	Red
Type and nature of the job performed	Green	Red	Red	Red
Position and prestige	Green	Red	Red	Red
Work-life balance	Green	Red	Red	Red
Job organisation	Green	Red	Red	Red
Job satisfaction	Green	Red	Red	Red
Good relationships and effective communication	Green	Red	Red	Red
Delegation	Green	Red	Red	Red
Teamwork	Green	Red	Red	Red
Recognition, praise and constructive criticism	Green	Red	Red	Red
Use of creativity and imagination	Green	Red	Red	Red
Job content changes	Green	Red	Red	Red
Relevant job assignments	Green	Red	Red	Red
Firm's technological facilities	Green	Red	Red	Red
Conveniences (kitchenette, changing rooms...)	Green	Red	Red	Red

Solving difficult tasks	Red	Red	Red	Red
Feedback	Green	Green	Green	Green
Individual job contents	Green	Green	Green	Green

Source: Authors

Although the job perks quadrant shows the hugest differences, all employers think that benefits tailored to the staff's needs are a strong stimulus. The working environment quadrant enjoys the heaviest use where harmonious relationships with workers, effective in-house communication and trustworthiness are integral for efficient human resource management and high corporate performance. Especially investments in good interpersonal communication go a long way.

Interviews also revealed whether the employers use other benefits suggested in Table 2. The red colour marks the unused, while green indicates applied job perks.

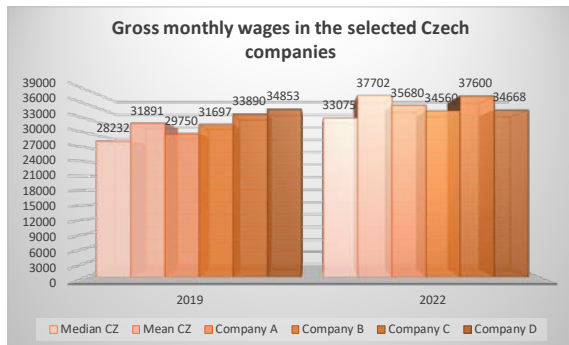
Table 2: The use of benefits in the companies

Stimulus	Company A	Company B	Company C	Company D
Meal vouchers	Green	Red	Red	Red
Contribution to public transport, local or urban transport	Green	Red	Red	Red
Clothing contribution	Green	Red	Red	Red
Preferred housing	Green	Red	Red	Red
Child care (contribution to nursery schools, kindergartens, children camps)	Green	Red	Red	Red
Holiday contributions	Green	Red	Red	Red
Financial aids	Green	Red	Red	Red
Contribution to the contributory pension scheme	Green	Red	Red	Red
Contribution to life insurance	Green	Red	Red	Red
Above-standard days off	Green	Red	Red	Red
Online medical consultations	Green	Red	Red	Red
Education and development beyond the firm's immediate needs	Green	Red	Red	Red
Free-of charge-refreshment at the workplace	Green	Red	Red	Red
Gifts and vouchers at special occasions	Green	Red	Red	Red
Pet-friendly offices	Green	Red	Red	Red
Physiotherapist in the workplace	Green	Red	Red	Red
Transport to work	Green	Red	Red	Red
Cars for private purposes	Green	Red	Red	Red
Laptop and other IT	Green	Red	Red	Red
Phone and phone operator services	Green	Red	Red	Red
Above-standard healthcare for employees and their relatives	Green	Red	Red	Red
Sport, recreational and cultural activities	Green	Red	Red	Red
Cafeteria (flexible benefits)	Green	Red	Red	Red
A four-day working week	Green	Red	Red	Red
Part-time jobs for parents	Green	Red	Red	Red
Wellbeing established	Green	Red	Red	Red

Source: Authors

Benefits comprise six groups, witnessing equal significance of financial and non-financial bonuses. On top of the listed job perks, employers offer interest-free loans and the use of company facilities and equipment for personal needs.

Well-deserved rewards are strong stimuli, inspiring staff loyalty and reducing labour turnover. Although Graph 1 suggests disparate gross wages throughout the analysed enterprises, they reflect gross incomes commonly received in the Czech Republic, acquired by the mean and median. Firms may use wages to motivate workers and stay competitive in the Czech market, preventing high labour turnover to better-paid companies.



Graph 1: Gross monthly wages in the selected Czech firms
Source: Authors

4.2 How employers of construction SMEs see the future of rewarding and motivating workers?

All strategic visions lead to retaining the workforce. Motivation and reward systems must jointly comply with the staff’s needs, requiring fairness and continuous update to personal satisfaction. The interviews suggest that employers will take essential steps in establishing a new reward and motivation system. The first move involves an annual wage increase and exploring other reward possibilities, including the target or performance bonus components. Managers will also focus on expanding the benefits range, like using contractors’ rebates for personal needs.

4.3 Is staff motivated and satisfied with rewards?

Although motivation systems embrace many aspects, they should always seek harmony between employers and employees. The observation of one of the analysed companies revealed wisely-chosen incentives, stimulating staff performance. The employees responded on their work motivation and satisfaction with the wage system, bonuses and benefits. Forty-six men responded to the questionnaire, excluding administrative, personnel and accountant positions, indicating a return rate of 86.79%. The respondents have predominantly been working in the same post for 4-6 years (34.78%), lacking motivation for higher performance (63.04%), having a worthwhile job (67.39%) and deriving deep job satisfaction (60.87%).

We extended the benefits range to four quadrants, including bonuses, training and development, job perks, and a working environment to wholly understand staff preferences in the construction engineering sector. All quadrants involve several motivation aspects, which employees evaluated on the Likert scale. From calculating the extent, weight, weighted evaluation and max weighted evaluation, we received a rate of 71.61%, indicating generally high motivation.

Workers chiefly appreciate modern technologies in the company (4.65), basic salary (4.21), bonuses (3.93), facilities and conveniences (kitchenettes, changing rooms ...) (3.82), and performance-related wages (3.59). On the other hand, employees the least enjoy delegation (0.67), changes in job objectives (0.93), Cafeteria – flexible benefits (0.96), a possibility to actively look for education (1.00), and the type and nature of the work performed (1.23).

Motivation aspects spread among the quadrants involve bonuses (3.82 = 87.50%), job perks (2.62 = 73.28%), working environment (2.21 = 68.38%) and education and development (1.97 = 63.59%). The quadrant of transactional and individual relationships indicates the strongest motivation, as depicted in Figure 2.

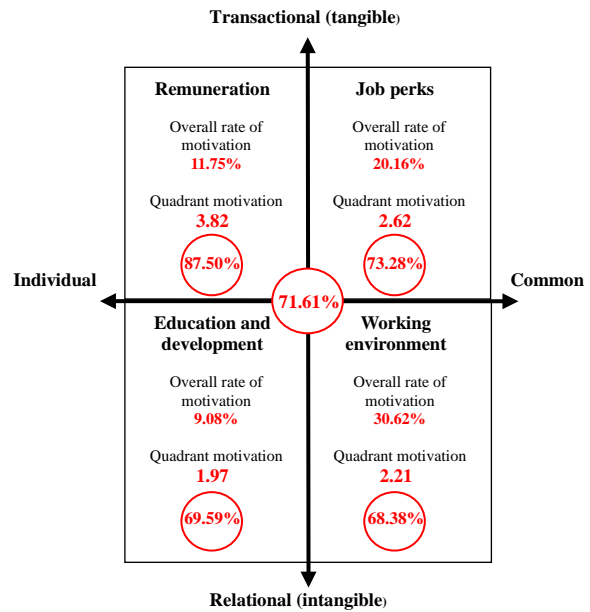


Figure 2: Staff motivation according to the quadrants
Source: Authors

Staff satisfaction with the corporate stimuli peaks at 69.58%, indicating weaker contentment than in previous cases.

Employees scale their happiness about the firm fulfilling as follows: the job perks quadrant (2.82 = 75.67%), bonuses (2.53 = 71.69%), working environment (2.28 = 67.70%) and education and development (1.89 = 61.76%). See Figure 3 for more detail. Workers are the happiest about the company performing transactional and mutual relationships.

Job satisfaction ensures staff’s well-being, encouraging creativity, engagement and high performance. That is why companies incorporated the stimulating working environment into their portfolios.

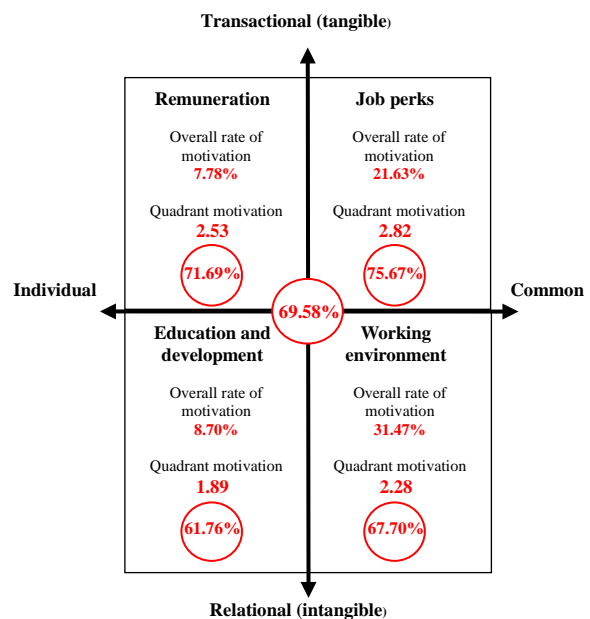


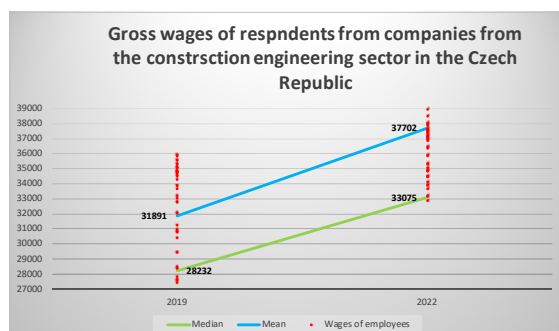
Figure 3: Staff satisfaction according to the quadrants
Source: Authors

Benefits showed a rate of 64.37%, the lowest score in the satisfaction assessment, indicating poor motivation. Employees may not need or profit from them, leading to a lack of stimulation. Companies should survey their impacts and tailor the benefits to the staff's needs.

The job perks fall into six motivation groups according to strength: pension benefits (3.51 = 83.70%), bonuses (2.04 = 66.96%), days off and life benefits (1.86 = 62.28%), workplace and team benefits (1.75 = 61.24%), health perks (1.26 = 50.54%) and extra education (0.72 = 37.83%). Wisely chosen benefits for strengthening staff motivation is integral for cornering the labour market.

Rewarding is another powerful stimulus. Although most employees understand the payroll system (67.39%) and do not think they will get more money elsewhere (63.04%), some workers have no idea about the system functioning (13.04%). The lack of knowledge makes these people think they will be better off elsewhere (26.09%). To talk these workers out of thinking so, employers must educate these workers about the reward system. The quadrants suggest that companies largely accept monetary incentives (43.48%). Financial bonuses may also reflect gross wages between 2019 and 2022. Their median was 33,716 CZK in 2019, rising to 37,000 CZK in 2022.

The standard deviation for 2019 was 2,968.16 CZK of the mean and 5,194.71 CZK of the median, witnessing a fall to 2,189.16 (mean) and 3,624.36 (median) in 2022. Respondents' wages did not deviate from the Czech standard in 2022. The respondents' wage median contains more serious inconsistencies, as its figures are closer to the average than the mean value. See Graph 2 for more detail. We may say that respondents' wages do not depart much from the average payments in other construction companies and are highly competitive in the sector.



Graph 2: Gross wages of respondents from companies from the construction engineering sector in the Czech Republic
Source: Authors

4.4 Differences in motivating and rewarding throughout the SME construction engineering sector in the surveyed regions

The data analysis and previous chapters suggest only minor differences in motivating and rewarding in the sector that depends on the regions (Jihočeský Region, Liberecký Region, Vysočina and Středočeský Region). The quadrants show that all firms use a motivation aspect, suggesting that only Company D does not motivate employees in education and development. All companies agreed that allowing workers to use corporate facilities for private purposes is a great encouragement. Employers think some aspects are not essential, and the staff would not show interest in them. All managers also recommend using benefits, although not all employees would appreciate them.

The last item on the list is wages. Although payrolls vary throughout the observed enterprises, companies try to level them at least with their region. The firm's competitiveness in the regional and know these impacts and align the wages with the region and the Czech Republic to prevent massive labour turnover.

5 Conclusion

The study aimed to evaluate motivating and rewarding employees of SMEs in the construction engineering sector in the Czech Republic. Although all enterprises have human resource management giving employees stimuli like basic salary, education or favourable working environment, staff preferences vary. We used a questionnaire to explore different incentives that employees appreciate. Our findings indicated no differences between the motivation aspects in the selected regions, showing competitive wages with other companies in the same locality. We then calculated the extent, weight, weighted and max weighted assessment. Although the results revealed many stimuli workers benefit from, they generally prefer financial bonuses and individually the firm's technological facilities. Yet, satisfaction with fulfilling these aspects is low, so companies should focus on these encouragements. The study suggests continuously updating the stimuli, as human resource management involves a dynamic process.

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Primary Paper Section: A

Secondary Paper Section: EA, AH

DO CHILDREN CARRY A STORK? OR THE IMAGE OF SEXUAL INTERCOURSE DURING SEX COMMUNICATION IN THE FAMILY

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Abstract: The aim of the paper is to find out what is the content of sexual communication between mothers and children and how mothers communicate sexual topics with their children. The paper is based on a research investigation in which a qualitative research approach was applied. The data collection tool was a semi-structured interview with 26 mothers who had children aged 12-18 years. Some grounded theory procedures were used in the data analysis. The results show that mothers formulate their messages about sexual intercourse depending on the age of the children and the so-called sexual events that the children have experienced. In terms of form, it turns out that mothers formulate their messages in three forms - sexual facts, sexual lessons, sexual examples. These are variable in terms of the intention that the mother wants to achieve. Mothers apply these forms separately or combine them.

Keywords: Sexual education, sexual intercourse, mother, children, family.

1 Introduction

In this paper, I address the issue of sexual socialization of children aged 12-18. The aim of the paper is to find out what is the content of sexual communication between mothers and children and how mothers communicate sexual topics with their children.

The family is, by its very nature, an environment of primary sexual socialisation, i.e. an environment where the child is sexually socialised from early childhood. The child forms attitudes towards sexuality from childhood onwards, through his or her family (Štěrbová, 2005). Definitions of family from the above-mentioned disciplines often refer to the variability of family forms (Cheal 2002, Možný, 2006) or to the functions of the family (Matějček, 2007; Cheal, 2002). According to Dunovský (1999, p. 91) "a small primary social group, based on the union of a man and a woman, on the blood relationship of parents and children or on a relationship substituting it, on a common household whose members fulfil socially determined and recognised roles resulting from cohabitation, and on the totality of functions which condition the existence of this community and give it its own meaning in relation to individuals and the whole society"

We can speak of today's family as a postmodern family (Možný, 2006). Among the basic attributes of the family are its functions, although they are changing. Možný (2006) mention the reproductive, socialization, care, protection, economic, and emotional functions. However, the presence of these functions depends on the type of family. There is a gradual loss of the listed functions of the family due to the shift from traditional to postmodern family. Nowadays, the family is of great importance especially in the emotional sphere¹ (Singly, 1999).

The theme of the paper refers to the socialization function. The family has a significant influence on the child's orientation in the outside world. In particular, its role in the course of an individual's primary sexual socialization is essential. According to Singly (1999), the most significant is the same-sex parent. The parent's parenting style is important for the socialization of the individual in the family².

The current form of the family in the Czech Republic is based on the process of transformation of the family and marriage that began in Western European culture in the 1960s. The changes were manifested in particular in trends in birth and marriage

rates. Rabušic (2001), referring to the sociologist van de Kaa, lists in particular the following shifts, which are typical of the postmodern era: A shift from marriage to unmarried cohabitation; a shift from contraception as a means of protection against unwanted pregnancy to contraception that allows for a self-fulfilling choice of whether and when to have a child at all; a shift from an era in which the child was the centre of parents' lives (king-child with parents) to an era in which the centre of life is the couple and their child (king-pair with a child); a shift from uniform families and households to pluralistic forms of families and households. Against the backdrop of the above-mentioned family transformations, a sexual socialisation process is taking place which itself, in the context of social constructivism, is influenced by the transformations of family life.

If we want to categorize and systematize the content of intentional sexual socialization³, we can find inspiration from other research (Macdowall, Wellings, Mercer, Nanchahal, Copas ... Johnson, 2006). Macdowall and his colleagues worked on the large national NATSAL survey conducted in the UK in 2000. Respondents were people aged 16-44 years, 11,161 in total. The researchers report three main categories of content – biological, risk behaviour reduction and psychosocial. Within the biological category are topics related to the mechanical and biological aspects of human reproduction, with content on the development of the female and male human body, how children are born, as well as sexual intercourse. For the second category, related to the reduction of risky behaviour, the content touches on the consequences that risky sexual behaviour can have. Topics related to sexually transmitted diseases and prevention strategies – contraception and family planning – are covered. Within the psychosocial category, there are themes related to homosexuality, masturbation, the pleasure of sexual intercourse, refusal of sexual intercourse in case of disinterest, emotions and relationships. This distribution was also the basis for their research, which found that for research participants aged 16-29 years who felt they did not have enough knowledge during their first sexual experiences, there was a particular need for more knowledge in the psychosocial area, as well as a need for more information about the health risks of sexual behaviour and protection against it. In the case of the psychosocial content category, I am referring to topics related to homosexuality, masturbation, sexual pleasure, emotions, etc. Research shows that topics in the psychosocial category are suppressed in families (cf. Macdowall Wellings, Mercer, Nanchahal, Copas ... Johnson, 2006; Miller, Kotchick, Dorsey, Forehand, & Ham, 1998). However, this is coupled with the fact that these topics require a good family climate and a great deal of openness because they are very sensitive topics. After all, the topics in the biological category and the category related to sexual behavior reduction are more technical and tend to be more general and do not need to be made as specific. Whereas the topic of masturbation, for example, can be a very sensitive and personal topic, but this is also related to social perception. It is not rare to talk to friends or colleagues about sexual intercourse, but who talks to them about masturbation that an individual may experience during sexual intercourse?

The positive aspects of sexual intercourse tend to be little mentioned in children. The reason is clear, namely to delay sexual intercourse. It is precisely because of the potential risks of sexual intercourse that the content of sexual communication in the family is often directed towards the risks associated with sexual intercourse, etc. Fogarty and Wyatt (2011) talk about topics such as contraception, sexual behavior, and sexually transmitted diseases, which are also mentioned by others (Fischer, 1987; King & Lorusso, 1997; Miller, Kotchick, Dorsey, Forehand, & Ham, 1998; Jerman & Constantine, 2010). They also mention the most discussed topics as: sexual

¹ In relation to this, de Singly (1999) refers to today's family as a relational family. We have a strong relationship with our family because we have a strong relationship with our parents.

² Helus (2004) considers the parenting style of parents as one of the crucial factors of socialization in the family. Baumrind (in Helus, 2004) mentions authoritarian parenting style, permissive and authority-based styles.

³ So we can also talk about sex education.

intercourse, reproduction, family planning, homosexuality, and sexual abuse.

Another categorization of content is offered by Hepburn (1983), who examined communication about sexual topics between parents and their daughters. He classified three categories of topics. The first one he called "big talk", which refers to instruction about conception and menstruation. These topics are included by parents in early adolescence. The second one he called "tea talks" and refers to family values, which are then reflected in the behavior of individuals. The third area he called "social issues". This area is discussed later in adolescence and involves topics related to abortion, unwanted pregnancy and promiscuity.

Research by Whitaker, Miller, May, and Levin (1999) is indicative of content that has a protectionist background – towards safe sex, delaying intercourse, and condom use. Indeed, in sexual communication aimed at children and young people, sex itself as an activity is often constructed as something dangerous.

If we look at foreign research, we find three areas that can influence the content of sexual communication in the family: the sexual experiences of children, the gender-related needs of children, and the gender of the parents themselves.

Raffaelli, Bogenschneider, and Flood (1998) found that whether parents think or know that their children have had sexual intercourse affects the content of sexual communication in the family. If mothers know, the content tends to be about talking about intercourse, what it is like, etc. For fathers, this information causes them to direct their educational activity towards the dangers of AIDS and other STDs, as well as towards family planning.

Inazu and Fox (1980) came to a similar conclusion about the influence of content due to children's sexual activity.⁴ The research was conducted in Detroit and Michigan through interviews with 449 mothers and their daughters who ranged in age from 14-16 years. The interviews with the mother and her daughter were conducted separately but at the same time. The interview data were handled quantitatively. The focus of their research was on sex education between mother and daughter before and after first sexual intercourse. They reported that prior to the daughters' sexual activity, the mother's educational influence was more related to the prevention of sexual experimentation by moralizing and providing general information about sex. The moment mothers know or assume that their daughters are sexually active, their role in the educational process shifts towards a guiding role. They give more practical advice to their daughters and orient them to the topic of planned parenthood (Inazu & Fox, 1980). As children begin their sexual lives, parents feel that their children are closer to parental responsibilities, hence they engage this topic.

Interesting findings in the context of gender can be found in the research of foreign experts (Macdowall, Wellings, Mercer, Nanchahal, Copas ... Johnson, 2006). For 19% of the female research sample, there was a need to talk about the topic of how to refuse a request or offer of sexual intercourse, while for 9% of the male research sample this was the case. While men (21%), much more than women (15%), wanted to know how sex can be more satisfying. This is linked to the fact that it is topics in the psychosocial category that are underserved. It is possible that both men and women have little information in the areas mentioned, that their sex education in the family is not sufficient in this regard. We can hardly say that women receive enough information about how sex can be satisfying or that they are taught more about this topic. Nor can we say that for men, sexual communication in the family is much more guided on how to say

no than on how sex can be satisfying. The difference is due to the needs of the recipients of sex education.

This research also found that both fathers and mothers are much more likely to discuss the topic of avoiding sexual intercourse and the risk of STI and HIV transmission with girls than they are with boys at the same age. While the use of protection is much more discussed, by both mothers and fathers, with boys than with girls. Other research (Dilorio, Kelley, & Hockenberry-Eaton, 1999) also confirms that STDs and condom use are more frequently discussed with sons. Sexual communication with daughters is directed more toward delaying sex, and with boys toward being careful about sexual intercourse. The required abstinence for girls is intended to lead to the prevention of pregnancy and disease. These results are consistent with other research (Raffaelli, Bogenschneider, & Flood, 1998⁵; Swain, Ackerman, & Ackerman, 2005⁶). The authors (Raffaelli, Bogenschneider, & Flood, 1998) explain this by stating that the impact from the absence of sexual communication may be more severe for daughters than for sons. This is a phenomenon that tends to be described in the context of the so-called natural sexuality discourse as a double standard in judging male and female sexual behaviour. Indeed, women's sexuality is more regulated and controlled as a result of this construction.

There is no doubt that the content of sexual communication in the family differs according to the gender of the parents. Research shows that mothers communicate much more with their children about the negative consequences of sexual intercourse than fathers (Byers, Sears, & Weaver, 2008; Eisenberg, Sieving, Bearinger, Swain, & Resnick, 2006). How can this fact be explained? It is possible that the mother can imagine more realistically than the father what would take place if, for example, an unwanted pregnancy or STD occurred. It is also true that this consequence would affect the woman-mother much more than the man-father. Another possible explanation is that fathers are much more reluctant than mothers to admit that their children have had sexual intercourse, especially for girls, as indicated by the findings of Jerman and Constantine (2010).

The contents vary with the age of the children. Jerman and Constantine (2010) argue that as children get older, the number of topics discussed with children increases. Other researchers such as Raffaelli, Bogenschneider and Flood (1998) concur and further discuss that in addition to the age of the children, similarity is influenced by the age of the parents, the composition of the household, the education level of the parents and the employment status of the mother.

2 Methodology

This paper focuses on a sub-part of a larger research investigation that was part of a dissertation project (Kamanová, 2018). Its aim is to find out what is the content of mother-daughter sexual communication on the topic of sexual intercourse and how mothers communicate with their children on this topic.

A qualitative research approach was chosen to answer the objective. A total of 31 semi-structured interviews were used for data analysis, from 26 respondents. According to the established rules of qualitative research, all interviews were recorded and then transcribed. The recorded interviews lasted between 40 and

⁴ The research was conducted in Detroit and Michigan through interviews with 449 mothers and their daughters who ranged in age from 14-16 years. The interviews with the mother and her daughter were conducted separately but at the same time. The interview data were handled quantitatively.

⁵ Raffaelli Bogenschneider and Flood (1998) conducted a survey in the Midwestern United States. Respondents included 666 mothers and 510 fathers and their 15-year-old child. Children and their parents were interviewed. Differences in the resulting numbers of respondents are due to the fact that some children lived with only one parent. In total, 1176 mothers and fathers participated in the survey, completing a 131-item questionnaire, and 1227 children aged 15 years completed a 160-item questionnaire.

⁶ Swain, Ackerman, and Ackerman (2005) conducted extensive research that focused, among other things, on the characteristics of parents who do and do not implement sex education. The research involved 866 parents from Wisconsin and Minnesota who had children ages 13-17. The sample consisted of 282 men and 584 women. Parents were interviewed by telephone. The constructed questionnaire contained 12 scaled questions.

120 minutes. Data were collected in four phases with respect to the process of continuous data analysis.

The primary criterion for sample selection was that the mother had at least one child aged 12-18 years. The reason for the choice of the age of the child is the fact that it is a period of physiological changes and a period of first sexual experiences, which is evidenced by the results of research by Weiss and Zvěřina (2009), whose team conducted continuous research on sexual behaviour in the Czech Republic in 1993, 1998, 2003 and 2008. The authors report that in the last 10 years the age of first kiss, first date and falling in love has stabilized around the age of 15. The age of first non-coital activity is around 16 for males and 17 for females, and the age of first sexual intercourse is around 18, with adolescents entering into their first long-term partnerships around 18.

The research participants were selected by snowball sampling method, by randomly approaching potential respondents and also from the circle of acquaintances. However, adherence to the pre-determined criteria for the sample was essential, as was the variability of the sample.

The approach adopted for data analysis was based in part on the use of two strands of grounded theory represented by Strauss and Corbin (1999) and Charmaz (2006), in particular the procedures of open and thematic coding, analytic induction and constant comparison.

It is evident from the nature of qualitative research that the results present the respondents' point of view. The research results cannot be generalised. Of course, the issue of data validity is also relevant due to the sensitivity of the topic (Jermaň & Constantine, 2010; Lefkowitz & Stoppa, 2006). To increase the validity of the research, I used temporal triangulation (collecting data at different times and over a longer period of time) and local triangulation (collecting data at different locations). To increase the validity of the research, I also used the technique of triangulation of the people collecting the data, as some of the data was collected by other researchers. Obviously, a certain limitation of any research work is the data analysis itself, especially in the case of the subjectivity of the researcher himself. Although it is everyone's endeavour to do their best to reduce that subjectivity. In relation to this, I have used the technique of peer reflection. I continuously consulted with them and presented them with partial results of my analysis. This technique allowed me to broaden the possible perspectives on the analysis and to check my own analytical procedures and results.

3 Main results of the research survey

The content that mothers convey to their children in the course of communication about sexual topics is very differentiated. However, they are mainly related to the following three topics: phenomena associated with physiological changes, we can talk about physiological events (menstruation, polo, etc.); autoeroticism; sexual intercourse.

In the context of the sexual socialization of children, the physiological events that accompany the adolescence of both daughters and sons are particularly relevant. "So I said to him, 'Well, that's just what happens to big guys, and so that's kind of the way to go when he's a big guy, so that's kind of the way to control it.'" (Dara) In this case, the poluce is constructed as an indicator of masculinity. In contrast, some mothers portray pollution as a condition of masculinity. The topic of pollutions featured prominently in the so-called deferred message⁷. The mothers delegate the message to another person, which is quite often the mother's partner or father, as we can see for example in Adela's case: "but as a son I postponed it to my daddy, let them talk about it, because I don't know what to say to him either". We learn from Adela's account that she did not find sexual

discussion with her son entirely easy and tried to shift responsibility to her father⁸. The mothers also postponed the disclosure until later, on the topic of erections, "Nothing, we've moved on. Just: 'Honzik, you know. That's it, it'll go down in a minute. Like that you, you pee in peace. And when you want to, we'll talk about it.' But it hasn't come to that yet." Hedwig offers her son another solution by delaying the sexual communication.

Menstruation resonated very strongly in the data, but especially towards daughters. In their testimonies, mothers described their first menstruation as an unforgettable experience. Most mothers were able to describe the moment they got their first period. A very strong spatial memory is evident in the reflections. Mothers vividly describe where they were when they first got their period, on what occasion it was and in what premises. Further, they are able to accurately describe with whom they discussed the onset of menstruation, whereas they are unable to age the onset of menstruation accurately. Menstruation itself was a very significant moment for them, which is then reflected in their own daughters' experience of menstruation.

The moment of the first menstruation of daughters is perceived by mothers as a purely positive event, which is often accompanied by congratulations and the rapid spread of this event to other family members or acquaintances. Menstruation is constructed as a symbol of health because it makes a woman able to fulfil her maternal role. Menstruation is strongly linked in the accounts to the possibility of having children. It is verbalized as a condition and gateway to pregnancy, with all the necessary accompanying symptoms such as pain or mood swings. However, these accompanying symptoms are described as a toll of motherhood. With menstruation, mothers report pain, for which there is a tendency to identify. Mothers make inferences about the level of their menstrual pain based on the level of pain their daughters will experience.

Menstruation is presented in the testimonies of the participants as a sign of adulthood: "Well, that's what we said, like she's just grown up, she's not a puppy anymore, and she might be when she starts to fuss and starts to bleed, because they saw it..." (Jana) The testimonies even included the ritualization of this act - eating dinner together, buying menstrual aids and bras. Monika even describes a mother-daughter celebration: "When she got her first period, we said she had grown into a woman. And that we were going to celebrate it yeah ... So I think it should be well, because she became a woman That's the initiation into a woman."

From the testimonies we learn that mothers say that daughters become more vulnerable at the moment of menstruation and therefore need more protection and care. It is also a moment that provides the impetus for more intensive educational action by mothers in this area. This is due to the possible complications associated with menstruation and the delayed social role of the mother, as described by Josefina, for example: "But it's a fact that like in me it used to say, but now it's no fun, since it has. Anything can happen now."

Menstruation and polo are both constructed by some participants as a given, as Marie describes, which we cannot control: "That it is a natural thing, from a certain age onwards, is a given. That as we eat, as we breathe, we women have to bleed." Or Milena: "Marta, it's just part of life as(.). You'll have breasts, you'll get your period(.) I say that's just the way it is."

Another content area is autoeroticism. This is a topic that is a silent topic for many of the participants. It is not just a matter of silence towards one's own children. While the mothers were able to talk about themselves as sexually active persons, none of the mothers associated their person with autoeroticism. If mothers do talk about it, autoeroticism is constructed by mothers as an intimate and private matter: "My daughter, I mean I would say she has been into it from an early age. So there we rather dealt

⁷ Delayed communication also appeared in other topics, but was more pronounced in the topic of pollutions or erections.

⁸ For sons, mothers are more likely to use delayed communication. They try to refer to fathers as socialising agents. However, in many cases, sons rather require mothers.

with it not to go anywhere, ... that it's nothing like wrong, but it's not for strange eyes like ..." (Adela) For this reason, most participants do not talk about this topic with their children. This behaviour of the mothers is related to their own boundaries of intimacy and to the perception of the unimportance of this topic. At the same time, this image reflects a social norm – autoeroticism is not talked about⁹.

In mothers who talk to their children about this topic, we encounter targeted regulation in their statements, which takes place in two variants. There is the regulation of the activity itself and the regulation of the environment where the activity is carried out. In the statements whose content is the regulation of the activity, we find negative statements about autoeroticism. Autoeroticism is the topic that was the most controversial in the interviews conducted. For this topic, religious beliefs were strongly associated with attitudes towards autoeroticism. Those mothers who declared Christianity as their professed religion referred to autoeroticism as an inappropriate activity. These mothers' beliefs were strongly connected to their accepted norms. Monica conveys the message to her daughter that it is a substitute: *'Come on, so again...we've come across this topic with my daughter. So the explanation was given by me, like that's what it is, like to me it looks like a substitute yeah. That...of course I don't see anything like criminal about it. No way, but that...it's just a substitute. That's not the way to go in my opinion, yeah.'* The testimony should lead to an end to this activity. For Adela, again, environmental regulation can be seen, *"So that maybe when we're watching TV, that she should keep it, that...yeah, that we just kind of suggested...well, that she should hide with it."* Monica described herself as a believer. She professes to be a Roman Catholic. According to other statements, I believe that her opinion on masturbation is formed in light of the official opinion of the church to which the participant adheres. Mothers who discuss this topic with their children often point out that it is an activity that should be done in private. Mothers try to refer autoeroticism in children to other spaces. Mothers who used environmental regulation did not use activity regulation.

For mothers who communicated with their children about sexual intercourse, I encountered in their accounts a disavowal of sexual intercourse by the mothers themselves. In the data, I identified three possible levels of communication about intercourse that answer the following questions: what it looks like (explanation of the form), what is gained (explanation of the benefits), and what is needed (conditions of intercourse).

Some mothers explained sexual intercourse on the basis of the emotional side of intercourse: *'when two people like each other'*. This is more of a pseudo-explanation, the mothers do not go into detail - *"it happens when two people love each other"*; *"it is a kind of caress between a man and a woman"*. Sexual intercourse is explained as an act of love and a certain closeness between the partners. Children learn nothing about the physical union between a man and a woman. However, there are also statements in the data which are more specific. The form of sexual intercourse is described as *'union'*. The mothers convey information to the children about the penetration of the man into the woman and about the genitals: *'Yeah, that just – yeah, and so I told them that the man had a penis, that the woman had like, I don't know how I told them now (laughs), but that there must be some kind of fondling. So I told them cuddling. And that the man has the sperm and the woman has the egg and there's going to be a union and that's going to make the baby, right.'*

A switching mechanism was evident in multi-child families. For some children, mothers explained sexual intercourse using the first option and for another child they worked with the second option. The boundary between the two modes is the acquisition

of sexual events in the form of the initiation of menstruation, pollutions, first kiss or first sexual contacts with the opposite sex.

The benefit of sexual intercourse was a frequent theme in the data. The mothers' statements then refer to gain or threat. I encountered gain, for example, in Josephine's or Angela's statement, *"And when the moment comes, she will be theoretically ready and it will be a wonderful experience for her."* The gain of sexual intercourse can be pleasure. Mothers, however, tend to describe intercourse as a threat.

Sexual intercourse is also constructed as a conditional act. Mothers express to their children certain conditions that they should observe during sexual intercourse. Mothers make the age of legal maturity a condition for starting a sexual life: *"And I think I've discussed this with him before, that it's punishable under 15 and all that."* (Dagmar) and psychological maturity, as with Alena: *"I try to set an example by always saying that it's about something else when she's more mature, that those kids can't get anything out of it, that it's just not for kids, like she feels like she's not mature for it herself, so I'm trying to be like."* Boys are more likely to be warned by their mothers about the limits of legal maturity, and daughters are more likely to be warned about psychological maturity. Mothers in this case apply a double standard.

Most mothers associate sexual intercourse with love. Some mothers even attribute mythical qualities to intercourse – it should come at the right time, it should be with the right person, it is something unique: *"... that it's going to carry with it for quite a long time when it's the first time, that it's just going to be something special, it should be something special."* (Emilie) In Maria's imagination, sex is the culmination of the relationship, as it is for Monica: *"...that it should really, that it should be like the culmination of the relationship yeah."*

Sexual intercourse is also relationally conditioned in the mothers' accounts. Sex must be performed with someone with whom one is in a relationship. The mothers construct it as an activity not to be realised with someone one does not know: *"... and that I was just telling her that I would like it to be a boyfriend, so that she would be with him for a longer period of time, so that it wouldn't be really, just at the disco, that it's quite important."* (Emilie) For mothers, it's not about one-off contact, it's about contact with someone the child is in a relationship with¹⁰. Unlike the modern scenario, it is not about the individual having sex with someone they love, but with someone they are in a relationship with.

For mothers who had children of both sexes, it was evident that they communicated relational conditioning more intensely to their daughters than to their sons. I suspect that the reason for this is that mothers are constantly threatened by the threat of unplanned daughter pregnancies. The relationship with the partner with whom the daughter has sexual intercourse is then at least a partial insurance that the man will not threaten her or, if necessary, will take part in dealing with an unexpected situation.

Most mothers also strongly verbalized the conditioning of personal preferences in their statements. Daughters and sons are the ones who decide with whom to have sexual intercourse. In this context, mothers clearly defined what is wanted sexual intercourse, what is abuse or rape. Boys were even warned by their mothers that they could be accused of abuse etc. The solution to this situation is seen by the mothers as having their sons have sex with someone they know. This fact is evidence of the transformation of the discourse on women's passivity and men's activity that has occurred in the traditional sexual cultural script.

Sexual intercourse is conditional on protection: *'And now that he's fifteen, I often say goodbye to him in a way that , ... like remember your best friend's name is a condom.'* (Dagmar)

⁹ Sexual taboos are historically and culturally conditioned. Despite the de-tabooing of sexual topics in society that has occurred in the postmodern era, autoeroticism is still a highly taboo topic. The tabooing of sexual topics in society is addressed in studies such as King and Lorusso (1997); Jaccard, Dittus, and Gordon (2000); Walker (2001) and Byers (2011). Sexual taboos are related to cultural sexual scripts.

¹⁰ Giddens (2012) uses the term pure relationship.

Martha places a lot of emphasis on protection because of STDs: *"I have not talked about contraception with someone like this yet, so if he doesn't know the person longer and like it's going to be accidental then no way(.)"* Martha's quote also already demonstrates a shift towards a more postmodern way of thinking about sexual behaviour, where it's not about having sex with someone I like. He admits to one-off intercourse, which is evidence of a move away from the concept of romantic love that is typical of the modern sexual scenario.

Cecilie has a very strong emphasis on protecting her son from her partner's pregnancy, which is why, for example, she buys condoms for her son: *"My partner says to me, 'Are you buying them condoms now?' And I say, 'Where are they going to go now and I'm going to be nervous here later tonight that they're going to go, that someone is going to risk it?' I say, 'He's coming from training, where's he going, I'm not going to worry about it now, I'm not going to send him somewhere for petrol tonight.' For me it's a reassurance, and that I have that peace of mind. Even if it's not total birth control, but if nothing else it's this. I know a lot of people probably won't agree with me buying it for him."* Cecilia forms a kind of coalition with her son, taking responsibility for her son's activity upon herself. Cecilia extends her son's childhood. Dagmar's take on the situation is similar to Cecilie's. The invention of contraception has greatly transformed the way the mother and father acquire their roles¹¹. With this method of protection, there is a greater degree of control over the acquisition of these social roles. Contraception offers reins for children and peace of mind for mothers: *"I don't really know. Maybe in the back of my mind I hope that being able to control my sex life through contraception will never be an issue on the agenda."* (Angela) Contraception allows girls to have protection in their own hands, as mothers encourage them to do, as mentioned by Simona or Magda for example: *"Sylvy, but if you do, you just have to come to me when you need to and we have to agree on contraception because you can never trust a boy and you have to protect yourself."* In some mothers' accounts, men are constructed as the irresponsible ones. Daughters are encouraged to be active.

Mothers often use information correction during the transmission of sexual intercourse messages¹². The goal is to correct information or clarification that children have or that is directed to them. For example, Vera channeled her son's idea of intercourse: *'When Honza said that the two of them were lying in bed and kissing. So I do-I present it to them in the spirit that if I like him.'* In Vera's case, the correction was purely substantive.

But what is the purpose of transmitting this content? Mothers are trying to influence the acquisition or continuation of specific social roles for their children. Rather, they focus on delaying the social role of the mother and, in this context, on prolonging the duration of the social role of the partner. Mothers do not direct information towards children learning the skills of sexual intercourse. The mothers' instruction is constructed in such a way that it is intended to lead to delaying the initiation of sexual intercourse or to protection during sexual intercourse.

At the most general level, we can say, based on the participants' statements, that the goals of sexual transmission are oriented towards the present, in the sense of accompanying, guiding and leading the children through life, and towards the future, i.e. towards upcoming life events. Participants mentioned that it is essentially about *'preparing for life'*. Vera even talks about *'dressing for life'*. Many of these general statements about general goals oriented towards the present and especially towards the future can be found in the participants' statements. Many of the mothers' general statements are related to the phrase *"success in life"* or *"succeed in life"*. However, it is important to understand what this success is linked to. Analysis of the data shows that the aforementioned phrases are linked to success in a

particular social role. Success means the conscious and desired acquisition of social roles and the readiness for them, as well as the absence of a moment of surprise or negative feelings when acquiring certain social roles.

Mothers use different forms of communication when teaching about sexual intercourse. Three forms can be identified in the data: sexual facts, sexual instruction, and sexual example. Mothers use these forms separately or in combination. By combining the forms, mothers try to emphasize the importance of the message and increase the effect of the message. What was the same for all the participants was the negative delineation towards so-called sexual tales, as we see for example in Jana: *"Like it wasn't that stork, how they walked around with it just. Jesus, it's pretty stupid to tell kids like that."* Mothers often heard these tales in their childhood, or some parents still use them according to them.

Sexual facts are brief statements about a given sexual issue. It is a factual and concise statement of specific content. An example can be found in the statement of Mary, who mentions how she described her daughter's menstruation: *"So we explained that we need to know that the number of eggs is a given in a woman and when it goes away, for example... Well, just that it's like the eggs don't develop during life, that they've been there since like since birth... once a month the egg is released and travels and if it is not fertilized on that pathway, it leaves with the blood, that's why every month the woman bleeds ..."* The excerpt shows that the message is factual and descriptive, without any value or emotional subtext. The normative character of the message does not appear.

This form is often used when the interest comes from the children or when the topics are more or less constant. The purpose is not to define how the child should behave, but rather to inform and present possible solutions. This form is aimed at giving the children an idea of what to expect. Sexual facts are used to supplement children's knowledge. The use of the example of animals was widely used in this form¹³. The mothers used their lives and behaviour to approximate the world of humans: *'Well, now we've got Besinka¹⁴, and she's started to fight now, and we also discussed why she fights like that. Or what it's like, and how the dogs are different from the people.'* (Jana)

Another form that can be encountered in the mothers' accounts is sexual instruction. This form is normative in nature. Sexual instruction carries a clear message. It is often expressed in a conditional way, e.g. *'you should use a condom when ...'* or *'be careful not to catch anything'*. The purpose is to instil certain principles and rules. Through sex education, mothers present their opinions, assessments, attitudes, etc. It is no longer a matter-of-fact and brief presentation of information.

Boundaries and norms are set with the help of sex education. Bára, for example, mentions the example of her daughter who found an older partner at an age when she was still under the legal limit: *"... She actually met her boyfriend when she was 14, so we talked about it at home, that there was no way we were going to have sex before 15. This example can also be used to demonstrate how children's sexual events transform the content of sexual scripts. Similarly to Bára, Marie describes, "That's criminal, I told her that if she's going to have sex and she's not 15 or she's going to be 15 and she's going to have sex with someone who's not 15..."*

When giving sex education, mothers often refer to professional public or legal measures in order to multiply the importance of the message and to add weight to the message. In this form, mothers make heavy use of the so-called 'shield of authority'. The authorities most often referred to by mothers are the well-known sexologists Radim Uzel and Jaroslav Zvěřina. However,

¹¹ Possible (1999) identifies contraception as one of the determinants of the third sexual revolution.

¹² I encountered correction of information on other topics as well, but on the topic of sexual intercourse it was very pronounced.

¹³ The most common example was the use of pets. Those that the children know, are in contact with and have a close relationship with.

¹⁴ This is a female that Jan's family breeds.

these claims are undoubtedly a reflection of the influence of the media world. They support their opinions by saying that this or that expert has the same opinion, that they have read it in a professional book, etc. The shield of authority is intended to reinforce the credibility and legitimacy of the mother's claims or actions externally. The mothers outwardly verbalize that it is not their decision, but that they are following the expert's opinion. In doing so, they want to support their own argumentation and thus add gravitas, importance and expertise to the sex education.

Mothers use gender comparisons in sex education¹⁵. In her testimony, Vera refers to a situation in which one of her children often suffered from laryngitis: *"... that as it belongs to life to have a cold, a cough and laryngitis, at that moment in our country, so when you grow up, the girl has one problem and the boy has the other problem... So we rather described it, I compared boys to girls and you will have a tendleten task ..."* (Vera)

There is an element of intimidation in sex instruction. It is intended to create a sense of importance and urgency. Dagmar describes a situation where she was giving her son sex ed in order to delay sex: *"...that he might just get pregnant with her or whatever, I say these are things that are threatening of course, but I say be aware of one thing, that you might even get that girl who decides that she's going to say that you raped her and you can do whatever you want and you can't help it in life, you always do, so he got scared of it."* Women are portrayed as dangerous in Dagmar's testimony. They are not portrayed as defenceless and passive as was typical in the traditional scenario.

The third form that mothers use is the sexual example. It is a description of some fact that has happened to someone in the neighbourhood. Mothers also use examples obtained from the media¹⁶, from professionals, or from books. The purpose of this form is basically to show the children in practice the saying that misfortune does not walk on mountains but on people. Typical in the mothers' accounts was the theme described by Magda: *"Or from different experiences of parents who have kids the same age, to be careful at those discos and stuff. Yeah, that actually somebody puts some of those drugs in their drinks, or pills, or just drugs. And then the girl doesn't really know what's going on with her, so that's what happens at these discos and these different events as well..."*

Cecilia, in turn, used close examples in conveying a sexual orientation message: *'Yeah, so quite, quite on that sexual orientation quite, quite we talk about it in relation to somebody being gay, somebody being - they're like two lesbians living here right now, so like yeah, so we talk about it...'* Mothers often use examples from their own neighbourhoods, as these are said to be as tangible as possible for the children. The use of negative examples seems to work. For example, Jana uses a negative example of her sister, who is a single mother: *"Well, I don't know. We have it now, for example, with our Danča, well, we talk about how the Danča just how she has it, like the girls just heard it too."* The sexual example also builds on the mother's storytelling skills and, to some extent, the creative tailoring of the story. The point is not to convey a true example, but rather to describe it in a way that suits the mother's intentions.

In this form, mothers use descriptions of their own sexual events. The mother communicates to the children that what she is telling them is not unique, but commonly happens in society. The mother tries to authenticate certain events. Bára, for example, *"And that I told the children one example that I had unprotected sex and then I had a dream that I got HIV or had HIV and that therefore it's a very good and effective protection against that person not to repeat that situation ... because I experienced such a horror ... in that dream, such a horror that when I woke up I said, never again in my life. That I just... like I told myself that maybe it was a rough experience, but that I really didn't... that I must never. That it's always worth the condom so that they don't*

have to worry for the rest of their lives." By sharing her sexual event with the children, Bára wanted to demonstrate to the children the importance of protection during sexual intercourse.

4 Discussion and conclusion

The content of sexual communication is mainly related to the physiological changes of children, autoeroticism and sexual intercourse. In the case of physiological changes, it is more about the topics of pollutions, erections and menstruation. On the topic of sexual intercourse, mothers often use 'deferred communication', which consists of delaying the topic or shifting it to the child's father or the mother's partner. In mothers' accounts, pollutions are constructed as an indicator of masculinity or as a condition of masculinity. For menstruation in particular, the following discourses are used: menstruation as a symbol of health, as a gateway to the child, as a natural part of life, as a sign of maturity, as a trigger of vulnerability.

Another content is autoeroticism. This is a topic that is widely tabooed among mothers. Other research has come to similar findings (Šilerová, 2003; Miller, Kotchick, Dorsey, Forehand, & Ham, 1998). Mothers address topics with their children that seem significant to them, which in some way threaten the children's lives. Risky topics are addressed. There is no danger to the family or to the mother herself from autoeroticism in the form of unwanted pregnancies of daughters and sons, etc., so this topic is not addressed as often as, for example, sexual intercourse. Another reason is also the limits of maternal intimacy, where masturbation is also a taboo topic in society. For mothers for whom this content is not absent, they regulate the place of masturbation or regulate the activity itself.

The topic of intercourse is presented in three levels that answer the following questions: what does it look like (explanation of the form), what do I get out of it (explanation of the benefits), what is needed for it (conditions of intercourse). For the explanation of the benefits, two discourses emerge - sex as pleasure and sex as a dangerous activity. Mothers mention that sex brings pleasure, but not often. This discourse is more often used with children who already have sexual intercourse. Mothers tend to describe sexual intercourse more as a dangerous activity. Mothers mention the following threats associated with sexual intercourse: pregnancy and sexually transmitted diseases, so they place great emphasis on protection during the act or delaying intercourse. Unplanned pregnancy is cited as one of the biggest threats, and is considered more of a woman's problem. Constructing sexual intercourse as a dangerous activity then brings us to the concept of risk (Beck, 2004; Giddens, 2013). The perception of sexual intercourse as a dangerous activity is the reason why mothers focus extensively on the protection associated with sexual intercourse. We can talk about protection before (meaning before intercourse) and protection during (meaning during intercourse - health protection and reproductive control). In this context, research by Whitaker, Miller, May and Levin (1999) mentions the content of sexual communication, which has a protective background - the orientation towards safe sex, delaying intercourse and condom use.

The research conducted (e.g., Swain, Ackerman, & Ackerman, 2005) is more indicative of the fact that sexual communication is directed towards delaying sexual intercourse for daughters and protection is not much addressed for sons. However, I cannot agree with this based on my research. Protection is directed towards both sexes, but the manner of protection differs. Sons are more likely to be protected during sexual intercourse. For daughters, it is double protection - before and during sexual intercourse. This is because daughters are perceived by mothers as being more at risk in the event of sexual intercourse. Mothers particularly see daughters as a threat of unwanted pregnancy, i.e. acquiring an unwanted social role as a mother. The acquired role is mainly a source of worry for the parents and complications for the daughter. Mothers apply a double standard. Different contents are directed towards daughters and sons.

¹⁵ Comparing the sexes using the example of a brother or sister seems to work.

¹⁶ A specific role is played by the endless soap operas that often fill TV stations.

From research conducted abroad, we learn (Raffaelli, Bogenschneider, & Flood, 1998; Swain, Ackerman, & Ackerman, 2005) that the message that sex is dangerous is conveyed to daughters rather than sons. According to my research, this message is received by both daughters and sons, but the reasons for the danger differ. According to mothers, daughters are at risk of unwanted pregnancies and venereal disease, while sons are at risk of venereal disease and the possibility of being accused of rape.

Daughters are encouraged to be active. The mothers are not interested in having sexual intercourse with someone they like, but in protecting themselves and having intercourse with someone they know. Mothers allow one-off intercourse between children, which is evidence of a departure from the concept of romantic love that is typical of modern times. I have encountered accounts that refer to the concept of co-morbid love rather than romantic love (Giddens, 2012). Mothers condition the initiation of sexual life on physical and psychological maturity. Boys are referred by mothers to the limit of legal maturity and daughters to psychological maturity. Mothers apply a double standard in this case. Sexual intercourse is also associated in mothers' accounts with personal preference and with relationship. Mothers do not condition sexual intercourse on love but on relationship. The main thing is not to be in love, but to have a good relationship - a partner with whom I understand, with whom I have similar interests, etc. The relational conditioning is communicated to daughters much more intensely than to sons. All of these attributes reflect the concept of pure relationship discussed by Giddens (2012).

The content and frequency of sexual communication is also influenced by specific events related to sexuality and sexual maturation that take place in children. I refer to these events as 'sexual events'. The specific sexual events are the physiological and relational changes that children experience during adolescence: breast growth, the appearance of pubic hair and beards; nocturnal sex in boys and menstruation in girls. The first relationship, first sexual intercourse and the associated first sexual experiences are also significant sexual events. A very significant turning point is a stable partnership. Raffaelli, Bogenschneider and Flood (1998) found that whether parents think or know that their children have had sexual intercourse influences the content of sex education in the family. If mothers know, the content of sex education tends to be directed towards talking about intercourse, what it is like, etc.

But what is the purpose of transmitting this content? With physiological changes, the aim is rather to inform and prepare children for the upcoming events. With autoeroticism, the aim is more towards regulating the activity or the environment where it is performed. For intercourse, they are intended to lead to delaying the initiation of sexual life - protection before, or protection during, intercourse.

On the basis of the findings, I believe that mothers deliberately influence the sexual socialisation of their children, mainly for profit, both for the mothers and for the children. The mothers want to minimize the risks that may arise from the absence of deliberate maternal action - sexual diseases of the children, unplanned pregnancies, etc. At the same time, by their deliberate actions, they want to increase the children's chances of experiences - a happy partner life, experience in sexual intercourse, etc. These findings lead us to consider parallels with the risk society discussed by Beck (Šubrt, 2007) and the experience society characterized by Schulze (Šubrt, 2008).

It is evident that the contents that are transmitted to children are constructed on the basis of cultural scripts, both modern and postmodern (Katrňák, 1999; Fafejta, 2016). Particularly in statements related to sexual intercourse, these traces of cultural scripts are evident. The data confirm the retreat of the discourse on the passive role of women and the active role of men. Women are encouraged to be active in protecting themselves and in being active during sexual intercourse itself.

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Primary Paper Section: A

Secondary Paper Section: AM

INCLUSIVE EDUCATION AS AN INSTRUMENT FOR PREVENTING SOCIAL EXCLUSION

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Abstract: The main aim of the paper is to present a view of inclusive education as a tool for preventing social exclusion. Our findings were obtained through qualitative research conducted in an environment at risk of social exclusion. The results confirm the important role of education in preventing social problems. In the discussion of the results, we will point out the need for intensive involvement of special education and emphasize the need for quality training of the actors of inclusive education.

Keywords: Inclusive Education, Social Exclusion, Special Educational Needs, Resocialization

1 Introduction

Social exclusion is a major issue that modern society is attempting to address. It has negative impacts not only on a local level but also on a national, European, and even global scale. In today's interconnected society, it is important to recognize that social exclusion issues in other countries or on other continents will have an impact on us. Therefore, it is crucial to strive for the elimination, prevention, and combat of social exclusion through all possible means. Inclusive education is a fundamental tool for achieving the goal of reducing social exclusion. This paper presents the findings of a long-term study that explores the impact of education on individuals at risk of social exclusion. The paper is divided into two sections, each with a distinct focus. The first section introduces the research methodology and presents the theoretical background of the investigation. The paper will then focus on the research setting and the research process. The findings will then be presented, highlighting the significant potential of education as a social prevention tool. It is important to note that the principles of inclusive education must be applied to ensure that the target group can attain appropriate academic results. In the conclusion of the paper, we provide recommendations for modifying the training of future educators to enhance their preparation for the current inclusive paradigm. This will improve the quality of our education system and have a positive impact on addressing social exclusion.

2 Methodology

We conduct research using a qualitative approach which has been highlighted in academic literature as having a significant impact on the modern inclusive paradigm (Lindsay 2003; Willing 2017). Qualitative research finds application in numerous disciplines such as sociology, anthropology, psychology, and educational sciences. The goal of qualitative research is to offer an extensive, profound, and meticulous comprehension of the investigation's research issue. Qualitative research yields the benefit of a comprehensive and thorough scrutiny of cases, empowering us to scrutinize their evolution and make specific comparisons. This implies that we do not simply observe superficially, but rather take into account the influence of context, nuances and conditions, enabling us to scrutinise individual processes and their impact on the entire research framework (Hendl 2016). Consequently, qualitative research is a method that aims to interpret and understand human behaviour and experience, utilising techniques such as observation, interviews and document analysis. Qualitative research is typically carried out on a limited scale involving a small group of participants and necessitates a comprehensive examination of the data collected. This type of research facilitates the capture of subjective views from individuals who are directly involved with the topic under investigation. Afterwards, these subjective experiences, perspectives, and opinions are transformed into scientific knowledge, through the aid of a qualitative design (Given 2008; Leavy 2014). One of the benefits of qualitative research is its ability to refine the subject

of inquiry and uncover new avenues, viewpoints, and research goals over time (Gulova and Šíp 2013).

Our research design consists of two stages. The first stage involves conducting interviews, observations, and analyzing pedagogical documentation for initial data collection. Subsequently, the information obtained goes through grounded theory methods and phenomenological interpretive analysis. The research methodology is regularly reviewed and tailored to fulfill the current research objectives. Research methodology involves a variety of instruments and techniques that allow for flexible responses to the research context and targeted population. Continuous refinement and incorporation of new research tools and methods contribute to ongoing enhancement. Research is viewed as a living and evolving process that requires appropriate tools and methods.

For this research, we have a unique opportunity to use several in-depth case studies. Case studies are a very effective research tool. Case study research, frequently linked with qualitative inquiry, has emerged as a valuable methodology for probing intricate issues in real-world scenarios. Employing case research becomes particularly relevant when examining a contemporary phenomenon (Patnaik and Pandey 2019; Hyett et al. 2014). The regular utilization of case studies as a research approach has presented certain challenges, which can be alleviated through the employment of highly precise language and careful research design (Eisenhardt 2007). However, because we are present in the researched environment as part of it for a long time, we are able to operate in the linguistic code of the target group. This advantage provides our qualitative research with the possibility of deep insight into the issues under study.

3 Course of the research

We're researching the children's home environment. Children's home is an educational institution for the provision of institutional care. The examined children's home is located in Prague, Czech Republic. This children's home consists of seven family groups with a total capacity of 54 children. It is a standard children's home intended primarily for children without serious behavioural problems. It is necessary to mention that the public, both lay and professional, is often unclear about the different types of educational institutions. Sometimes the generic term "institution" is used, which does not distinguish children's homes from other institutions, such as social service institutions, educational institutions or institutions for the social and legal protection of children. This is a serious mistake, as each institution has its own specific purpose and is intended for a clearly defined target group. The vast majority of children come from families that can be described as pathological. In recent years, there has been a slight change in the age distribution of new arrivals, with an increase in older children. There has also been a marked increase in the number of new arrivals requiring psychiatric care. Changes in the national composition of the home cannot be overlooked, with an increase in the number of children of different nationalities. After leaving the children's home, most children are at risk of social exclusion.

One of the main tasks of a children's home is to prepare children for successful reintegration into society. This task was the impetus for defining the primary research question framing the research presented in this paper. To what extent is the level of educational attainment linked to successful reintegration into society after leaving the children's home? The applicability of the definition of a child with special educational needs to the children's home target group has prompted the research question. It is crucial to consider that the children coming into the children's home from the pathological environment of their original families have been exposed to the negative influence of this pathological environment for a considerable period of time, and that this devastating influence cannot be expected not to be reflected in the level of special educational needs (Daněk 2022).

3.1 Case study

In this case study, we will present two children from the children's home under study, with whom we have worked for a long time in the past. Thus, we are familiar with their family history in detail, we know their health status, and we have reports from school counselling facilities. In order to preserve anonymity, we will follow the privacy policy, we will talk about Child A and Child B. Both children came to the children's home from dysfunctional family backgrounds at the same time. We were in intensive contact with both children throughout their stay in the children's home. We have also been in contact with them after they left the institution.

Child A's family was a family of severe substance abusers. Child A was born with withdrawal symptoms because mother abused methamphetamine. Very quickly, Child A developed behavioural problems. Child A came to the children's home at the age of 10 and started attending a mainstream primary school. Although Child A had a recommendation from the counselling centre for the assignment of a teaching assistant, the manifestations of behavioural disorders escalated. The school tried to accommodate the children's home as much as possible, but within two years the situation became unbearable. First, the children's home tried to find a specialised school for children with behavioural problems. Here, too, Child A was unable to manage her behavioural difficulties. This was followed by an attempt at home education where the children's home arranged for a qualified specialist. Again, this did not have the expected effect. The situation continued to deteriorate. However, the original family did not support Child A's transfer to a more appropriate institutional setting. However, after a further year, Child A was transferred to a children's home with a school. Today, Child A is still unable to manage the challenges associated with Child A's behavioural problems and is now placed in an educational institution. According to the information available, Child A is also facing significant educational challenges in this specialised educational institution.

Child B also came to the children's home from a disruptive environment. However, the original family did not have a history of substance abuse and it was a case of poor parenting skills. Child B also came to the children's home at the age of 10. As with Child A, behavioural problems began to manifest themselves in the children's home. However, the family cooperated closely and was willing to agree to Child B's transfer to a children's home with a school. The transfer took place very quickly. The scheme of the children's home and school proved to be an ideal educational space for Child B. After completing Child B's primary schooling, which was implemented in the children's home with a school, Child B returned to original family. Child B entered secondary school, from which Child B graduated. According to the information available to us, Child B is currently working, planning to start own family.

If we look at both cases, we can see some major differences. These differences were the cooperation of the family and their willingness to accept the child's special educational needs, but above all the provision of an adequate educational environment that met the child's needs. This significantly reduced the time that Child B was present in an educational reality that was not suitable for Child B. Whereas Child A remained for a long period of time in an environment that was not prepared to meet the requirements arising from special educational needs. Without adequate special education intervention, negative behavioural patterns were reinforced, which subsequently negatively affected the entire future life trajectory. Whereas Child B was very quickly given the opportunity for specialised intervention which led to the acquisition of behavioural models.

4 Inclusive education within the target group

Inclusive education is a teaching and learning approach designed to empower educators in addressing the unique needs of individual learners. It aims to prevent the marginalization that may arise when certain students are treated differently, fostering

an environment where every student can thrive (Florian and Spratt 2013; Zilcher 2019).

It is necessary to realize that the target area of the research, i.e. the institutional environment, is in a very specific position in the context of inclusive education. Children's homes in the Czech Republic are part of the school system, as it follows from their official name, educational institutions for the performance of institutional care. Education is not only limited to the time-space of the school, but also extends to the individual's home environment, in our case the children's home. The main role in education, i.e. in the process of upbringing and education (Průcha 2015), is played by pedagogical staff, in our case educators. As Lee (2015) rightly points out, the readiness of the educator for the specifics of working with children with special educational needs is quite necessary. It depends significantly on the educational worker's attitude towards the ideas of inclusive education and also on the willingness to apply these ideas to pedagogical practice (Cook et al. 2007). Although the economic cost of inclusive education is often cited, the gains for the student with special needs resulting from their participation in education are far greater than the costs of that education (Hibel et al. 2010).

Inclusive education requires close collaboration between schools and students' families (Baria 2023), which is a major concern in the case of our research. As we have repeatedly demonstrated in previous research activities, original families are largely uncooperative (Daněk 2023). Our findings suggest that the lack of importance indigenous families place on education makes them even less interested in the issue of inclusive education. Thus, if we add the fact that even in the intact population, we can still observe barriers to the full adoption of inclusive ideas (Pivik et al. 2002), we can identify our target group as at risk of exclusion from the inclusive paradigm.

Therefore, if the individual does not have the opportunity to fully fulfill his/her educational potential, there is a danger that undesirable behaviour patterns may emerge. Research indicates that experiencing stress and academic setbacks in school can trigger emotions of inadequacy and powerlessness, consequently leading to certain manifestations of self-destructive behaviour (Macanovič et al. 2023). According to recent reviews, education is a significant preventive factor when it comes to criminal activity leading to incarceration (Drahy et al. 2018).

5 Conclusion

Social exclusion can manifest in diverse ways, underscoring the importance of acknowledging the versatility and extensive impact of this concept (Sen 2001). Moreover, it is important to realise that in order to fully understand the issue of poverty, it is necessary to adopt the perspective of the poverty-stricken individual, otherwise biased conclusions may be reached (Halleröd 2006). In the Central European cultural environment, the awareness of the class stratification of society is not yet fully anchored. This can be attributed to the four decades when an officially class society did not exist. However, a middle class has gradually emerged, whose support has significantly activated the potential of their children (Lareau 2002). At the same time, it has also created population groups that have become socially excluded, without access to the opportunities for said activation. This implies a further deepening of social inequalities and stratification of society.

Without inclusive support for all students with special educational needs, today's education system is at considerable risk (Basit and Tomlinson 2012). Not only the education system, but also society itself. Without a sound education, it is very difficult to get a good job. Without good jobs, the risk of falling into poverty is evident. And poverty is one of the significant factors reducing access to quality education (Main and Bradshaw 2012; Ferguson et al. 2007). So, we see here a vicious circle of hopelessness that does not allow an individual to be realized in today's society. Nevertheless, we are optimistic. We live in a democratic society. We can argue that the process of inclusion is

possible especially in a society that is democratic at its core (Nilholm, 2006). Inclusion should be understood not only as an important value of the educational system (Norwich, 2005), but as a fundamental pillar of the social system. Inclusive ideals cannot be achieved without the methods of special education; therefore, special education can be described as a tool for social change (Stárek, 2023a). Ideals and goals are realized by people. Therefore, in order to fulfill inclusive goals, the training of special educators needs to be significantly improved (Stárek 2023b). In addition to special educators, it is critical that inclusive ideas be passed on to educators at all levels of education, from kindergarten through college. Most importantly, inclusive ideas must be presented outside of the school setting and must become an integral component of society. Only then will inclusive education be able to fulfil its potential and be an effective tool for preventing social exclusion.

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EXPLORATORY PATH ANALYSIS OF LIFE-CHOICE STRATEGIC DECISION-MAKING: THE CASE OF TERTIARY EDUCATION ENROLLMENT

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Abstract: This paper examines laypeople's strategic decision-making by focusing on the example of tertiary education enrollment, a strategic life choice with long-term implications. The study design follows a standard decision-making approach, considering available alternatives, evaluation criteria, and decision-making process while exploring emotions' role in this context. Qualitative responses from a survey (n=527) were analyzed and coded for quantitative analysis. The findings reveal differences between the reported decision-making process and the standard approach, emphasizing the influence of emotions. Two distinct decision-making paths related to short- and long-term benefits in enrollment choices were identified, leading to policy recommendations. The research highlights the mediating effect of dominantly negative emotions on decision and satisfaction and the distinctive relationship between dominantly positive and negative emotions on decision outcomes. Particularly, the role of dominantly negative emotions in the long-term context suggests their influence in enhancing strategic orientation during decision-making processes. Additionally, the study challenges the conventional separation between causes, evaluation criteria, and alternatives in decision-making models, suggesting the need for improved methods that account for interconnectedness.

Keywords: strategic decision-making; emotions; transitional choice; tertiary education enrollment; long-term implications; path modelling

1 Introduction

Life choices regarding higher education enrollment, career and job choices, detachment from the family home and choice of residence, partnership formation, and having children can be understood as transitional choices [1], [2]. The path of solving the transitional choices is not linear, and there can be a regression to an earlier stage, discontinuity, or rapid progression. Still, in any case, it is assumed that those choices bear long-term consequences for the success and quality of a person's life. Completing such decisions is understood as a threshold for ending youthhood and entering adulthood. However, due to those choices' importance and long-term consequences, they may also be seen as strategic choices in one's life – parallel to managers' strategic decision-making. An event is considered strategic in a business environment if it is 'important, in terms of the actions taken, the resources committed, or the precedents set' [3]. Hence, the decision about enrollment in higher education can be understood as a strategic decision-making event in one's life. On the other hand, understanding decisions about enrollment in higher education may help design policies and nudges to achieve European Commission goals in Croatia, aiming for the share of 25-34 year-olds with tertiary educational attainment in a population of minimally 45% by 2030 [4].

If the event of the enrollment choice is observed through the lenses of strategic decision-making, the managerial approach to decision-making must be a starting point. Strategic management and decision sciences usually describe the decision-making process through stages. Such an approach observes decision-making as a process that presumably follows the stages of identifying and defining the problem, determining the set of alternatives, determining the evaluation criteria, applying the evaluation criteria, and choosing an alternative [5]. The decision-making process is a part of the problem-solving process, which also incorporates the choice of implementation and appraisal of the consequences. In strategic events, the decision-making process can also be observed as strategic decision-making in a narrow sense and the process of problem-solving as strategic decision-making in a broader sense [6]. In both cases, the stated approach also assumes that the decision-maker is rational, well-informed, objective in the assessment, and most often has autonomy over the decision-making process. Still, the classical approach also involves the possibility of using quantitative

methods to support decision-making, which contributes to rationality and objectivity.

However, some choices inherently involve subjectivity and personal preferences, which contributed to developing multicriteria decision-making methods (for example, [7], [8]). Buchanan et al. [7] addressed the issue of the perception of the alternatives and the role of the perception in alternatives evaluation that deviates from the classical understanding of the evaluation. The role of personal factors in decision-making has also been acknowledged in managerial decision-making [9]. The notion of entirely human managers and decision-makers opened the question of the role of emotions in strategic decision-making [6]. Emotions can be understood as subjective experiences that occur as a reaction to a stimulus and can have various consequences [10].

The research on the role of emotions in decision-making differs in approaches and observed stages in decision-making. Emotions can be observed as activators that trigger the awareness of the problem and increase engagement in decision-making [11]. Similarly, Schwartz [12] proposes that emotions can serve as information that activates and guides decision-making. In line with that thought, Loewenstein et al. [13] suggest that emotions may act as risk and uncertainty indicators. Gaudine and Thorne [14] highlight the importance of the level of emotional arousal, while Andrade and Ariely [15] show that even fleeting emotions may have a long-term impact on behavior.

Researchers predominantly assume that emotions play a role in decision-making as a bias or have a moderating effect ([11], [16], [17], [18], [19]). For strategic decision-making in a narrow sense, dominantly positive emotions induce the formulation of a competitive goal, and dominantly negative emotions lead to a focal goal [6], [20]. During the stage of alternative generation, dominantly negative emotions lead to a more systematic approach, whereby dominantly positive emotions lead to a flexible and relaxed approach [21]. Anger is related to a person's sense of responsibility and autonomy, and it is directed toward another person blamed for a situation that undermines responsibility and autonomy [16], [22]. Fear stems from risk, uncertainty, and a perceived lack of control [16]. In the alternatives' evaluation and decision-making stage, fear and anxiety cause aversion to the riskier alternatives, while happiness and anger increase riskier behavior [6], [13]. Sadness leads to focusing on the details [23], creativity, and generating more alternatives, appreciation, original choices, and choices closer to the optimum [18]. On the contrary, dominantly positive emotions, such as happiness, signal a good state and lead to superficial assessment and judgment with the choices that deviate more from the optimum [18]. More generally, Schwarz [12] suggests that emotions help govern an individual's decisions and behavior by avoiding dominantly negative emotions and directing them toward dominantly positive emotions.

Self-determination, as the ability to take primary control over one's life and do that in a personally meaningful way [24], enables the person to act as a causal agent [25]. However, even when acting as causal agents, people's choices are shaped by emotions. Besides emotions, individuals' choices can be driven by several other influences. First, personal preferences, beliefs, perceptions, and interests can direct available alternatives perception, as well as the selection of the criteria for evaluation [25], [26], [27].

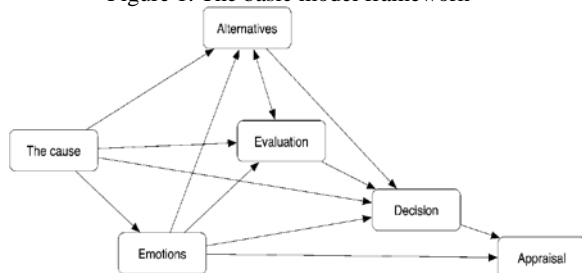
For a decision about enrollment in higher education, there can be a parental or family influence or friends' and peers' influences. Individuals value higher education concerning family values, transferred by socialization [28]. Moreover, parental opinions may be strong, or the parents may be controlling, thereby causing a diminishing sense of a person's autonomy, intrinsic

motivation, creativity, and conceptual understanding [29], [30], [31]. The peer influence may be relevant for persons who decide on enrollment in youthhood, where research focuses on the impact on risky decisions and prosocial behavior [32], concluding that it depends on the context and may be positive or negative.

Moreover, a socioeconomic environment may play a role at the micro-level (for example, the values and financial possibilities related to a family) and macro-level (for example, the dominant values in a country, opportunities for continuing education, etc.) and thus creating actual and perceived limitations in decision-making. The socioeconomic status of an individual or their family [33], [34] can influence the perception of available alternatives and direct occupational choice, regardless of their school performance [35]. Political, economic, cultural, geographical, and historical circumstances enclose an environment where individuals make choices [36]. The measures introduced by the government or institutions (or the lack thereof) can act as enabling or limiting aspects of decision-making. While policymakers underline individual freedom, they create socially structured patterns [36] that can direct a person's choices toward enrollment and a perspective field choice (or not).

Starting from the classical approach to decision-making, additional insights reveal the complex mosaic of the influences present in strategic decision-making, emphasizing the higher education enrollment decision. This paper explores the individuals' decision-making processes for higher education enrolment within a classical framework, with a particular interest in the role of emotions (Figure 1).

Figure 1. The basic model framework



Instead of the decision-making issue definition or problem identification, which would be the decision about higher education enrollment, the causes or triggers are introduced. If people do not recognize the causes of the problem, they probably do not recognize the need to decide on the subject matter. However, the lack of an action or a decision is an action in itself, and a missed opportunity bears its own set of consequences.

The causes, alternatives, and evaluation criteria may be subjective, biased, and influenced by a person's environment. It is assumed that the causes lead to the alternatives' generation and evaluation criteria selection and trigger emotions. Moreover, it is assumed that there is an effect of emotions on the alternatives' generation and evaluation. Given the previous findings, the relationship between the alternatives and evaluation is fuzzy. Some criteria may be present even at the alternatives' generation stage, denoted by a two-way arrow in Figure 1. The alternatives and their evaluation lead to the decision, as does the assumed mediating effect of emotions. The decision-making event, the consequences of the decision, and emotional enhancement lead to the appraisal of the decision-making event. Such a setting enables the examination of the role of emotions in strategic decision-making in a broader sense and the exploration of the relevant factors for satisfaction with the choice and its consequences, as well as the comparison to the classical approach.

This research aims to gain a better understanding of laypeople's strategic decision-making, starting from a classical decision-

making framework. The first research objective is determining whether laypeople's strategic decision-making adheres to the presumed process (Figure 1). The second research objective is to determine the specific effects of the causes, alternatives, and emotions on the decision and the event appraisal.

The paper continues to the Methodology section and description of the questionnaire creation and data collection. The first part of the analysis involves qualitative investigation, describing data coding and grouping. The second part of the analysis regards the quantitative analysis of the coded data based on path analysis. The following section conveys the results of the analyses. The discussion section examines the effects in line with previous findings and their implications for further research. The conclusion summarizes the main aspects of the paper, focusing on the contributions, limitations, and possibilities of further investigation.

2 Materials and Methods

2.1 Questionnaire

This research uses a developed questionnaire approved as ethically acceptable within the "The role of emotions in decision-making" research framework by the Decision of the Commission for the Evaluation of the Ethics of Research on 9.12.2019 at the Juraj Dobrila University of Pula. Informed consent was obtained on the first page of the questionnaire for each respondent. The questionnaire content and item description are available in the Supplementary file (Table 1).

2.2 Data Collection and the Sample

The sampling for this exploratory research was a quota sample stratified by age group and gender. The goal was to obtain enough data to include various experiences by each gender and each age group. The age is stratified into the following groups: born in 1964 or before, born between 1965 and 1980, born between 1981 and 1994, and after 1995. Thus, the targeted respondents are Croatian adults (18 years or older).

The questionnaire was distributed online from January to June 2020. The business economics students were engaged as pollsters within the graded assignments about data collection (Statistics in economy) and decision-making (Management, Strategic management). By June 2020, 590 responses were collected, of which 527 were complete, which is considered an excellent response rate for a questionnaire with an open-ended question.

2.3 Qualitative Analysis

The questionnaire involves qualitative responses, which should be coded for further analysis. The first question is open-ended, and explanatory answers are coded. The content of the responses was coded by only two human coders—the researchers. Cohen Kappa confirms high interrater reliability for coded causes, alternatives, evaluation, and satisfaction (0.873, 0.976, 0.926, and 0.988, respectively). The coding of the first open-ended question consists of a quantitative and a qualitative part. Quantitative is brought to the enrollment or non-enrollment in the high education (binary) and the satisfaction (three levels) with the chosen option. The qualitative aspects of the first question were: the reason or cause of college enrollment or non-enrollment, the alternatives to this decision, and evaluation criteria in decisions about higher education enrollment or non-enrollment. The complete coding process is described in detail in the Supplementary file.

2.4 Path Analysis

Understanding and predicting choices and behaviors in social sciences often involve latent variables, resulting in complex statistical models [37]. PLS path modeling is the appropriate method for further exploring the relationship of the variables in the decision-making process. The motivation to use this

approach is that PLS path modeling requires no assumptions about the underlying data. It can be applied in various situations and is favored if the structural model contains formatively measured constructs [38]. A characteristic of the technique is that it estimates the model's partial regression relationships, meaning that it examines each relationship separately and not all connections in the model at once.

However, it allows only recursive models, meaning the relationship between the alternatives and evaluation criteria must be examined separately. Also, its use in confirmatory applications is limited [38]. In this case, the method is used in the exploratory investigation, so its limitations should have little impact. The path modeling is conducted using SMART PLS software, v.3.3.7. [39].

One rarely utilized advantage of PLS-SEM is to model discrete choices [40]. According to the same authors and Lohmoller [41], the solution corresponds to a binary linear regression if a PLS path model has a dependent binary single-item construct. Hair et al. [40] argue that PLS-SEM can be used both for rational and heuristic decision-making, namely in the same area where traditional discrete choice modeling has been applied. However, the advantages of PLS-SEM path modeling also enable the distinction of rational and heuristic choices when parameter estimations as a whole are relevant [37].

Initially, coded nominal variables were recoded into separate binary variables for each identified cause, alternative, and evaluation criteria (1 indicates the occurrence, else 0). The emotions were grouped by averages into dominantly positive and dominantly negative emotions. Initial examinations showed that individual emotions create too much noise in the model and work better joined into groups of dominantly positive and negative emotions. The decision about the enrollment is coded one if they decided to enroll, else 0. In addition, the variables regarding satisfaction (the event appraisal, cognitive and affective aspects of satisfaction with the decision consequences) were coded 1 for negative, 3 for neutral, and 5 for positive appraisal to match the emotions' scale.

In this case, the enrollment decision is a single-item measure that stems from the nature of the observed phenomenon. However, single-item measures like enrollment are appropriate for measuring observable phenomena [38]. A person either chooses to enroll or not. While PLS path modeling can handle single-item constructs, such measures tend to influence the reliability and validity and increase estimates' biases, leading to the models' lower predictive ability [42]. This is identified as a methodological limitation. Another methodological limitation is non-normal distributions of grouped emotions, with more expressed skewness and kurtosis for dominantly positive emotions with inflation of zeros. That might lead to problems in assessing the parameters' significance by inflating standard errors from bootstrapping.

The model structure is based on the theoretically assumed process of decision-making, based on the classical approach, and enriched for emotions (Figure 1). However, the data enables additional examination of the causes, alternatives, and evaluation criteria. The variables related to the cause are indicators that construct the group of causes. Similarly, the alternatives and evaluation criteria variables are treated as manifest variables that form the alternatives and evaluation criteria groups. Thus, the exogenous latent variables are the causes, alternatives, and criteria groups. The relationships between the constructs are examined in line with the basic framework (Figure 1). The event appraisal and cognitive and affective satisfaction with the decision consequences reflect the overall satisfaction (endogenous latent variable). While the primary interest is to examine the mediating effect of emotions in decision-making about enrollment, as an example of strategic decision-making in a narrow sense, such a model setting also allows for the examination of the event appraisal (based both on the decision-making event and its consequences), thus extending the example to strategic decision-making in a broader sense.

The initially assumed relationships were integrated into the model, but some of the relationships proved to have low outer loadings and coefficients of low value and are not significant. Also, it is important to note that the analysis showed that gender and age display no relevant (in terms of effects) nor statistically significant relationship to any other variable. The possibility of constructing the cause, alternatives, and evaluation as in a single model was explored but discarded due to low outer loadings. However, the subsequent analysis yielded two complementary and significant models, revealing statistically significant relationships and better information criteria.

3 Results

3.1 Sample Description

Of 590 persons that approached filling in the questionnaire, 527 complete responses were collected. The resulting sample is mostly balanced in age and gender distributions. 54 % of respondents are female (Table 1). Most respondents were born between 1995 and 2010 (35.1%), while 21.82 % were born between 1981 and 1994, 22.39 % between 1965 and 1980, and 20.68 % before 1964. At the time of questionnaire completion, the youngest respondent was 20 years old, and the oldest was 71 years old. The sample is balanced with somewhat younger respondents compared to the general population.

Table 1. Respondents by age and gender

Gender/Age	<=1964	1965 - 1980	1981 - 1994	1995 - 2010	Total
Male	53	57	58	73	241 (45.73%)
Female	55	61	57	112	285 (54.07%)
Non-binary	1				1 (0.2%)
Total	109 (20.68%)	118 (22.39%)	115 (21.82%)	185 (35.1%)	527

The socioeconomic questions in the distributed questionnaire enable the examination of whether the sample reflects relevant educational characteristics of the population. The data from the last Census in 2021 is still being processed, so available final indicators of the distribution of education levels in Croatia are from the Census in 2011 [43]. According to the Census, 37.53 % of the population (15 years or older) finished elementary school, was enrolled in elementary school, or finished 1-3 or 4-7 grades. 47.06 % of the population finished high school, 4.07 % finished undergraduate studies, 7.8 % completed graduate studies, and in 0.67 % of the cases, the education level is other or unknown.

According to the same data, at the time of the Census in 2011, 45.23 % of the population 15 years or older finished or was enrolled in the general educational program (no specialization, such as elementary or grammar school), 22.67 % were educated in the field of engineering, manufacturing, or construction, 12.91 % in social sciences, 9.07 % in the services and the rest in agriculture, services, education, humanities and art, and natural sciences. In addition, there are more women (52.49 %) than men. Due to the 10-year difference and respondents' age, these data are not directly comparable to the sample, so an additional source is employed. Regarding the field of education, in 2019/2020 [44], the distribution of all enrolled students in Croatia indicated there were 45 % enrolled in social sciences, 26 % in technical sciences, 12 % enrolled in biomedicine and health, 7 % in humanities, 5 % in biotechnical sciences, 4 % in the natural sciences, 2 % in the interdisciplinary fields of science, and 2 % in the art field. The distribution has not changed much since the academic year 2013/2014. Again, the data is not directly comparable, as the report denotes only persons currently enrolled in higher education. However, combined with the Census, it indicates interest in the fields and approximates what can be expected in the sample.

Table 2 is a contingency table of respondents by their field of education and the highest completed level of education. It seems that the respondents span over higher levels of education than

Census 2011 indicates. The reason for such distribution may be the ongoing educational trends of higher enrollment rates, in line with the ET 2020 [45] goals of participation in lifelong learning and tertiary education attainment. Education and Training Monitor 2019 [46] reports a 12.8 % increase since 2009 in tertiary education attainment, and in 2019, 34.1 % of the persons aged 30-34 attained tertiary education in Croatia. Also, there is a coherence between the percentages of persons educated in social sciences in the sample and enrolled in the student population (by the AZVO report), with more educated in technical and natural sciences and lower shares of educated in other fields.

Table 2. Respondents by field and level of education

Field/ Highest level of education	High school	Undergraduate	Graduate	Postgraduate	Other	Total
Natural sciences	35	2	5	0	2	44
Biomedicine and healthcare	24	3	6	2	0	35
Technical sciences	117	15	21	4	2	159
Biotechnical sciences	2	1	2	0	1	6
Social sciences	141	62	25	5	8	241
Humanities	7	5	4	0	0	16
Interdisciplinary fields of science	6	1	1	0	0	8
Art field	14	1	2	0	0	17
Interdisciplinary fields of art	1	0	0	0	0	1
Total	347	90	66	11	13	527

Note: The fields are derived from scientific and art fields valid in Croatia (NN 118/2009).

While somewhat higher heterogeneity in the field of study was expected in the sample, the potential implications of the characteristics of collected data could lead to a bias. The field of education distribution can be related to the perceived possibilities and alternatives while deciding on enrollment. The qualitative data, especially the descriptions of perceived alternatives, could reveal if that was the case.

3.2 The Groups of Variables

Initial insights show that approximately 56 % of the respondents decided to continue their studies after high school. 75.52 % had no alternative in mind while deciding on continuing education. Only 0.19 % had two alternatives while making a choice, and 24.29% had one option besides the chosen one while deciding about education continuation. If there were an alternative, it was related to employment in 18.41 % of the cases. Most respondents (60.72 %) evaluated the alternatives according to personal preferences or personality. Following frequent evaluations refer to specialization and a better employment perspective. In 88.05 % of the cases, the possibilities were weighted by at least one evaluation criterion, while 11.95 % did not state any evaluation criteria. The most rarely applied evaluation criteria were the perceived quality of the study program, used by only 2.28 % of the respondents. Most respondents (58.94%) are satisfied with their choice, 11.6% are dissatisfied, and 29.47% are neither satisfied nor dissatisfied. The verbal statements indicate satisfaction with the choice in 19.17% of responses, and 5.45% verbally expressed dissatisfaction. The variable coding and grouping results are presented in Tables 3 - 5.

Table 3. Groups of causes for a decision about higher education enrollment

Group (frequency) Code	Reasons/ Causes	Code	Frequency	Examples of expressions
Unknown (70)	unknown		70	/
Financial (102) Code: CF	eager to get a job to earn money or already work	U1	52	"I didn't enroll in college because I got a job after high school."
	eager to earn more in the future (due to higher education)	U2	2	"I enrolled in college for a better salary in the future."
	unable to continue education because of the lack of funding	U3	45	"I did not enroll in college due to financial impossibility."
	unable to roll in the program in another town/ lack of funding	U4	3	"..but due to the proximity and the financial situation..."
Personal (243) Code: CP	aversion towards the learning	U5	9	"I'm just not for college. If I were focused and learning enough, interested in something, I would be in college. But I was not for learning properly, always friends, basketball, this - that. I wasn't even in school for learning."
	lack of desire or ambition	U6	42	"My decision not to enroll in college was due to the fact that I was not interested in college at all."
	uncertainty or a random choice of a study program	U7	9	"Because I was hesitant, I paused a year after high school. I wanted to enroll in the Faculty of Law ...but on all enrollment deadlines, I would always change my mind at the last minute... was a consequence of indecision..."
	desire to gain skills and knowledge, a better future perspective	U8	178	"I have always wanted to open my own business, and in order to gain prior knowledge that I could apply in business, I decided to enroll in management and entrepreneurship."
	did not get accepted into the desired program	U12	5	"I enrolled in ... because I didn't go where I wanted."
Social (84) Code: CS	family reasons	U9	14	"I didn't enroll in college because of my father's illness..."
	parents talked me into continuing education	U10	26	"My family ... encouraged me and made me interested in it."
	the lack of possibilities for enrolment	U11	21	"Other colleges did not accept me, I could only go to this one."
	social reasons (including war)	U13	23	"I chose my college because of the new environment, meeting new people, to become independent..." "I did not enroll in college because of the war in the country."
Vertical (28) Code: CV	continuation in the same field of study as the VET school	U14	28	"...I went to technical high school."

Table 4. Group of alternatives in deciding about higher education enrollment

Group (frequency) Code	Alternatives (besides the chosen one)	Code	Frequency	Examples of expressions
Unknown (313)	unknown		313	/
Employment (139) Code: AE	Employment	A1	139	"... go to college because, at this time, it is hard to find a job just with high school."
Another study program	Another field of study	A2	9	"... I was forced to enroll in this faculty, not the one I wanted."

(41) Code: AS	Same field of study in a different location	A3	11	"After thinking and thinking, I decided to study at the Faculty of Economics in Sarajevo... I decided to go to college in Croatia..."
	Another field of study in a different location	A4	8	"When choosing and enrolling in college... the alternative was the opposite of this faculty where I am currently... than moving to another city played a role."
	Another field of study in an exact location	A5	13	"My alternative was history and English, but since in the year of enrollment, this was not available ... the current faculty."
Delay (1) Code: AD	Postponing decision	A6	1	"I didn't enroll in college ..., but I intend to enroll next year."
Other (33) Code: AO	Other	A7	33	"I went abroad after high school, so I never enrolled in college."

Table 5. Groups of evaluation criteria in decisions about higher education enrollment

Group	Evaluation criteria	Code	Frequency	Examples of expressions
Long-term benefits (527) Code: EL	better employment perspective	V1	86	"...the profession as scarce and lucrative..."
	specialization of a study program	V6	116	"...because I believe that after graduation, I will have all the necessary competencies."
	personal preferences/proclivities	V8	325	"I was interested in economics and nothing else."
Short-term benefits (110) Code: ES	the cost of education	V2	54	"At the time when I was enrolling in college, the only financially viable opportunity for me to study was close to where I lived."
	start earning quicker	V3	56	"After high school, I immediately entered the job market because I needed the money..."
Quality (12) Code: EQ	perceived quality of a study program	V4	12	"The choice of faculty depends... on the quality of the faculty itself."
Limitations (38) Code: ER	family reasons	V5	38	"... to get away from my parents..."
Other (120) Code: EO	other	V7	120	"...because there are more opportunities in that city..."

3.3 Exploratory Path Models

During the analysis, it became clear that the enrollment decision is not as unique and straightforward a process as thought to be. First, the emotions had to be separated into dominantly positive and negative emotions due to their fundamentally different role and effects. Moreover, depending on the initial causes and reasons for the decision and the evaluation criteria, the enrolment decision modeling better captures the paths if separated into the two models. The reported models are selected based on information criteria (BIC) comparison. The first important difference between the models is that the first one encompasses the causes that can be seen as restrictive, while the second one involves the causes that can be seen as motivating. Probably a more significant distinction between the models is revealed with the short-term and long-term focus in the evaluation; hence it is used for naming them.

3.3.1. Evaluation of the measurement model

The proposed model contains formatively specified constructs, single-item constructs, and one reflective construct. As most constructs are formative, the evaluation emphasizes the formative measurement model.

In such cases, convergent validity is examined by redundancy analysis. The redundancy analysis has not been conducted in this case. The reason is that all the responses are coded from the qualitative responses. That means the unified construct is a binary variable corresponding to the indicators' values, thus creating a singular system.

The variance inflation factors (VIF) values (inner and outer) indicate no collinearity issues. All outer VIF values (Table 6) are below the conservative threshold of 3, so collinearity does not pose an issue in this case.

Table 6. VIF values

Constructs	Outer VIF values
Dominantly negative emotions (NEMO)	1.000
Dominantly positive emotions (PEMO)	1.000
Satisfaction (SAT)	
EA	1.6
CCA	1.806
ACA	1.262

Alternative-employment (AE)	1.000
Decision (D)	1.000
Causes – financial (CF)	
U1	1.01
U3	1.01
Causes – personal (CP)	
U5	1.002
U6	1.002
Causes – social (CS)	
U11	1.002
U13	1.002
Causes-theoretical (CT)	1.000
Causes-vertical (CV)	1.000
Evaluation – short-term benefits (ES)	
V2	1.008
V3	1.008
Evaluation – long-term benefits (EL)	
V1	1.031
V6	1.161
V8	1.164

The reliability measures are expressed only for the reflective construct (SAT), indicating sufficient reliability [47]. Rho_A is above the 0.7 cut-offs, and AVE is above 0.5 (Table 7). While one outer loading is below the suggested threshold of 0.708, its removal in exploratory analysis depends on its contribution to reliability. In this case, removing affective event appraisal (ACA) leads to lower reliability.

Table 7. Reliability measures for a reflective construct (SAT)

Construct	Outer loadings	Cronbach's Alpha	Rho_A	Rho_C	Average Variance Extracted (AVE)
Satisfaction (SAT)	EA 0.863 CCA 0.877 ACA 0.634	0.719	0.784	0.839	0.639

The heterotrait–monotrait ratios (HTMT, Table A.1, A.2) do not exceed the standard boundary of 0.85 for any correlation over the constructs. HTMT is a more reliable measure of discriminant validity than Fornell-Larcker criteria if indicators' loadings differ even slightly [48]. Therefore, the construct satisfies discriminant validity.

Table 8 offers an overview of indicator weights for both models. All indicators of formative constructs are statistically significant at a 1 % level. The lowest loading is 0.51, which is above the threshold of 0.5 [49], confirming the theoretical basis and implying the relevance of these indicators.

Table 8. Statistical significance and relevance of the indicator weights

Model 1	Sample mean	Standard deviation	T-statistics	P values	Outer weights
U1 → CF	0.598	0.063	9.536	0.000	0.51
U3 → CF	0.860	0.042	20.488	0.000	0.805
U11 → CS	0.734	0.139	5.370	0.000	0.716
U13 → CS	0.677	0.156	4.467	0.000	0.666
U5 → CP	0.575	0.199	2.924	0.003	0.55
U6 → CP	0.797	0.164	5.084	0.000	0.813
V2 → ES	0.763	0.059	12.940	0.000	0.817
V3 → ES	0.580	0.076	7.651	0.000	0.646
A1 ← AE	1.000	0.000			1
nemo ← NEMO	1.000	0.000			1
pemo ← PEMO	1.000	0.000			1
D ← D	1.000	0.000			1
Model 2	Sample mean	Standard deviation	T-statistics	P values	Outer weights
U14 ← CV	1.000	0.000			1
U8 ← CT	1.000	0.000			1
V1 → EL	0.432	0.055	7.912	0.000	0.569
V6 → EL	0.684	0.046	14.811	0.000	0.849
V8 → EL	0.286	0.060	4.812	0.000	0.599
A1 ← AE	1.000	0.000			1
nemo ← NEMO	1.000	0.000			1
pemo ← PEMO	1.000	0.000			1
D ← D	1.000	0.000			1

3.3.2 Evaluation of structural models

Several model characteristics must be considered while evaluating a model. First, a collinearity issue is examined using antecedent VIF values (Table 9). The VIF values range from 1 to 2.82, remaining below the conservative threshold of 3 and indicating that collinearity is not problematic for the models.

Table 9. Antecedent VIF values

Model 1			Model 2		
Antecedent	Construct	VIF value	Antecedent	Construct	VIF value
CS	AE	2.819	D	SAT	1.416
ES	AE	2.719	NEMO	SAT	1.414
D	SAT	1.579	CT	EL	1.316
NEMO	SAT	1.443	NEMO	D	1.315
ES	SAT	1.271	NEMO	EL	1.288
NEMO	D	1.156	EL	D	1.272
AE	D	1.156	AE	D	1.204
CF	NEMO	1.048	CV	EL	1.065
CS	AE	1.045	PEMO	SAT	1.040
CP	AE	1.043	CT	PEMO	1.000
PEMO	SAT	1.041	CT	NEMO	1.000
CO	NEMO	1.038	EL	AE	1.000
CS	NEMO	1.035			
CF	ES	1.000			
CS	PEMO	1.000			

A very important criterion for assessing the structural path model is the significance and relevance of the path coefficients [38]. All of the coefficients expressed in model 1 and model 2 are statistically significant at a 0.01 level of significance, except for the relationship between the ES and AE, which is statistically significant at a 0.05 level.

Model 1 (Figure 2) best describes the decision-making processes with the evaluation focused on the short-term benefits that frequently end up with a non-enrollment. The financial causes (CF) are formed with U1 (eager to get a job to earn money or already work) and U3 (unable to continue education because of the lack of funding), while U2 and U4 did not have sufficient loadings. The variables U11 (the lack of possibilities for enrolment) and U13 (sociopolitical reasons) explain social causes (CS), while U9 and U10 had low loadings and were removed. Personal causes in this model are formed by U5 (aversion towards learning) and U6 (lack of desire or ambition),

while U7 and U12 were removed. In addition, variable U8 did not perform well within the group of personal causes (CP). It was separated from the theoretical aspiration (CT), which did not prove relevant or significant for this model. Alternative evaluation (ES) is formed with V2 (the cost of education) and V3 (start earning quicker). Of all the alternatives, only AE (employment) proved relevant and remained in the model. The overall satisfaction (SAT) is reflected by the event appraisal (EA), cognitive consequences appraisal (CCA), and affective consequences appraisal (ACA).

Model 2 (Figure 3) best describes the decision-making processes with the evaluation focused on the long-term benefits that most frequently end with enrollment. This model's remaining variables are single-item constructs except for EL and SAT. Theoretical cause (CT) is variable U8, previously classified as part of the personal causes group, but it was identified as a separate, specific cause during the path analysis. The evaluation based on the long-term benefits (EL) is formed by V1 (better employment perspective), V6 (specialization), and V8 (personal preferences/ proclivities). As in model 1, in model 2, SAT is reflected by EA, CCA, and ACA.

Figure 2. The model of enrolment decision with the focus on short-term benefits (model 1)

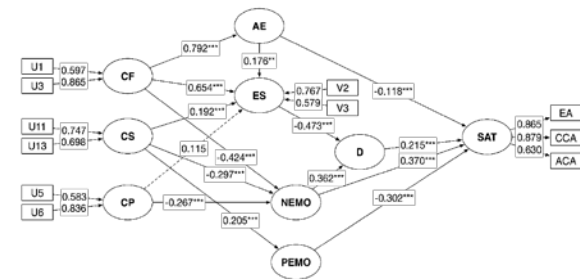


Figure 3. The model of enrolment decision with the focus on long-term benefits (model 2)

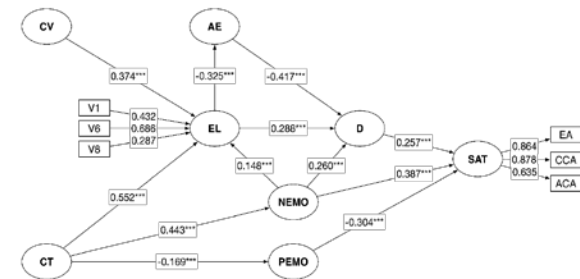


Table 10 shows R-squared and adjusted R-squared values for the constructs in both models. In the first model, the best-explained construct is ES (evaluation of alternatives oriented on the short-term benefits), followed by AE (alternative – employment). The best-explained constructs in the second model are D (decision about enrollment) and EL (evaluation of alternatives oriented on the long-term benefits). The least explained construct in both models is PEMO (dominantly positive emotions), meaning that whatever reasons or causes for the decision about the enrollment, they do not explain triggering these emotions well. However, some variations in NEMO (dominantly negative emotions) are explained by the causes (as the triggers). Model 1 shows a higher coefficient of determination when comparing the models, meaning it is somewhat easier to explain the choices based on the short-term evaluation. More precisely, the indicators revealed in responses better explain the relationships in the first model. The exception is the decision about enrollment (D), better explained in the second model. That might also mean that the decisions made focusing on the long-term benefits are harder to capture by respondents' recollections of the event. Overall, both models indicate moderate explicative power.

Table 10. R squared

Model 1	NEMO	PEMO	SAT	AE	D	ES
R^2	0.255	0.042	0.494	0.623	0.480	0.627
Adj R^2	0.251	0.040	0.490	0.620	0.478	0.627
Model 2	NEMO	PEMO	SAT	AE	D	EL
R^2	0.196	0.028	0.482	0.106	0.545	0.479
Adj R^2	0.195	0.027	0.479	0.104	0.542	0.476

In addition to revealed relationships, there are some statistically significant and relevant indirect effects (Table 11). In the first model, minor adverse effects on decisions and satisfaction from financial and social causes are mediated by dominantly negative emotions.

Table 11. Relevant specific indirect effects

Model	Specific Indirect Effects	Coefficients
Model 1	CF → NEMO → D	-0.153
	CF → ES → AE	0.14
	CF → AE → D	-0.309
	CF → NEMO → SAT	-0.157
	CS → NEMO → D	-0.107
	CS → NEMO → SAT	-0.11
	AE → D → SAT	-0.101
Model 2	CV → EL → D	0.108

Table 12. Mediation effects involving NEMO

Model	Relationship	Direct effect	Total effect	Specific indirect effect	Product of the paths	VAF (%)
Model 1	CF → NEMO → D	-0.275***	-0.528***	-0.153***	0.042	35.74
	CF → NEMO → SAT	-0.07	-0.363***	-0.157***	0.011	69.09
	CS → NEMO → D	-0.272***	-0.198***	-0.107***	0.029	28.31
	CS → NEMO → SAT	-0.234***	-0.214***	-0.11***	0.026	31.97
Model 2	CT → NEMO → SAT	0.196***	0.32***	0.172***	0.034	46.68
	CT → NEMO → D	0.35***	0.376***	0.115***	0.04	24.79

3 Discussion

The purpose of the research was to gain a better understanding of decision-making while individuals make important life choices, taking higher-education enrollment as an example. Such decisions can be understood as a strategic in a person's life, so a starting point was a classical strategic decision-making framework. The survey collected descriptive responses about their choices in higher education enrollment. The qualitative data was analyzed for initial insights and coded for quantitative path analysis.

The two models differ in the causes and evaluation criteria. The main difference is that the first model depicts strategic decisions on tertiary education attainment by evaluating alternatives with short-term benefits. However, the causes or the triggers also distinguish the paths – the inability to make any decision other than to earn money leads to such weighing of the alternatives. It can be concluded that the first model better demonstrates the path where the causes, alternatives, and evaluation of alternatives lead to the choice of not continuing education. In contrast, the second shows the path to enrollment into higher education programs. In addition, the first model comprises somewhat restrictive causes, and the second one includes motivating reasons. In both models, the causes are related to the evaluation criteria; the required breakdown into two models shows two fundamentally different paths in deciding about enrollment.

Moreover, the relationship between the causes and the alternative to enrollment is present in the first model but not in the second one. That confirms that for the respondents who decided on their enrollment in line with the first model, (mainly) the environment created restrictions perceived as the causes of making the decision. While this reminds of post-hoc justification bias, it also reveals that the first model basically describes the decision-making under restrictions, where the chosen alternative to education was - to an extent - forced. The lack of a relationship between the causes and alternatives in the second model can be interpreted such that the respondents were aware of employment as a possibility. However, it also suggests that their perceived alternatives stem from their assessment and not

	CT → EL → D	0.159
	CT → EL → AE	-0.179
	CV → EL → AE	-0.122
	CT → NEMO → SAT	0.172
	CT → NEMO → D	0.115
	AE → D → SAT	-0.107
	EL → AE → D	0.135

Given the emphasis on emotions, the revealed indirect effects point to possible mediation, which requires closer insight. In the first model, dominantly negative emotions demonstrate partial complementary mediation of the relationship of financial and social causes to decisions (Table 12), where variance accounted for (VAF) is 35.74%. The direct effect between financial causes and satisfaction is not significant, so no mediating effect occurs. The mediations of dominantly negative emotions on the relationships between social causes and decision and satisfaction are complementary, as both direct and indirect effects are significant and point in the same direction. Since VAF values are 28.31% and 31.97%, respectively, it can be concluded that partial mediation occurs. Similarly, in the second model, such mediation occurs for relationships between theoretical causes and decision (VAF=46.68%) and satisfaction (VAF=24.79%).

restrictions, allowing more free choice and causal agency [25] and resulting in more successful and profitable careers.

The most prominent effects show that the elimination of financial restrictions and encouragement of personal development and academic aspirations should lead to higher enrollment rates, which is in line with the set goals ("The share of 25-34 year-olds with tertiary educational attainment should be at least 45%, by 2030," [4]). Given that the current (latest available data from 2019) tertiary education attainment share is 34.1 % in Croatia and is below the EU average, the education policy should be driven to achieve the required growth in the following decade. An effort should be made to remove perceived barriers to continuing education regarding social and financial causes. Another way to encourage enrollment is to enhance the decision-making process by empowering high-school graduates with enough information and decision-making skills, emphasizing long-term focus.

The causes of financial, social, and personal nature lead to lower intensities of experiencing dominantly negative emotions. The ambivalent role of social reasons is revealed in its contribution to increased dominantly positive emotions (the first model). The theoretical reasons relate to increased dominantly negative and lower dominantly positive emotions (the second model). It is interesting to notice that the causes do not explain well dominantly positive emotions in either model. Still, in both models, dominantly positive emotions experienced at the time of the decision negatively affect satisfaction: quite contrary, dominantly negative emotions lead to higher satisfaction afterward. The biological approach to emotions argues that dominantly positive emotions signal a good state that does not have to be changed ([21], [6], [18]).

In contrast, dominantly negative emotions urge a person to change the situation. That logic can be applied in this case; if the respondents with experienced dominantly negative emotions acted upon them and changed their position, they experienced higher satisfaction afterward. Likewise, if the respondents who experienced dominantly positive emotions at the time were not compelled to change their situation and missed an opportunity, it later led to lower overall satisfaction. Such interpretation is

reinforced by the relationship between dominantly negative emotions and the decision, while the effect of dominantly positive emotions on the decision is not significant.

In addition, dominantly negative emotions mediate the effect of financial, social (first model), and theoretical (second model) causes on decision and satisfaction. In the first model, those effects are negative, and in the second, they are positive. That means respondents who experienced restrictive causes combined with dominantly negative emotions are less likely to enroll and have lower overall satisfaction. In contrast, reasons that can be seen as motivating, combined with dominantly negative emotions, lead to enrollment and higher satisfaction.

A significant effect on evaluation additionally emphasizes the role of dominantly negative emotions. Moreover, such a relationship appears only for a long-term evaluation (second model). Dominantly negative emotions enhance the evaluation towards - not just closer to optimal choice [18] but - to the long-term optimum.

The analysis yields two models with fundamentally different paths in enrollment choices: the first model, characterized by restrictive causes, emphasizes short-term benefits, while the second model, featuring motivating reasons, underscores long-term advantages. Strategic decision-making can be understood as a process of evaluating alternatives and choosing a course of action that aligns with long-term goals and objectives to achieve advantage and success. Only one of the two models satisfies the "long-term goals" criteria, so it can be argued that only the second model depicts strategic behavior. Moreover, the expression of dominantly negative emotions in the long-term context suggests their role in enhancing strategic orientation in decision-making, aligning with a focus on long-term strategic goals.

Both models indicate that the causes that trigger the decision-making process affect the evaluation criteria. The classical decision-making models with underlying rationality assumptions clearly distinguish the two. The same is true for the relationship between the alternatives and evaluation, where the two concepts should be kept separate. However, the models of higher education enrollment decisions show that causes affect the evaluation and evaluation affects the alternatives. Moreover, it seems that the causes and the circumstances at the time of decision skew or even block the perception or the awareness of all possible alternatives (model 1), lowering one's self-determination. In addition, both the considered alternatives and their evaluations may stem from a person's preferences (model 2) and thus increase self-determination [24], [25], [26], [27]. Another possible explanation for this finding may lie in post-hoc justification. In other words, while reflecting on the choices made, respondents may have focused on a single stream of possibilities that justify the chosen path.

Subjectivity in human decision-making is inevitable, and so are fallacies, biases, and heuristics. However, the implications of the findings to the causes-alternatives-evaluation criteria relationship relate to the models used to assist in decision-making that include a subjective approach. Many multicriteria decision-making methods include a subjective approach to the alternatives and evaluation criteria, requiring them to be kept separate. The exploratory models indicate that people are not good at achieving such separation. Should further research point out the same conclusion, that would mean that methods that employ a subjective approach could (should) be further improved to compensate for the inherent effect between the categories.

4 Conclusion

The paper deals with strategic decision-making in life choices while examining a choice of tertiary education enrollment. Such a choice can be considered a strategic event in one's life, as it bears importance through the involved resources, both committed and expected (knowledge, career, salary). A choice of this relevance in strategic management would involve setting the

objective, examining the alternatives, and evaluating the alternatives in line with a set of criteria.

Following the classic decision-making approach that involves determining the causes, available alternatives, evaluation criteria, and the decision as a guideline, along with adding emotions, a survey was conducted in Croatia. The collected qualitative responses were analyzed and later coded for quantitative analysis. The quantitative analysis involves exploratory path modeling. As such, the analysis can serve as an example of the possible use of PLS-SEM for coded qualitative data instead of standard survey data, with a cautionary note and a limitation regarding the redundancy analysis. In this case, the method enables a primarily formative model but reveals possibilities for further use of the methodology.

The approach highlights the subjective nature of decision-making, particularly regarding causes, alternatives, and evaluation criteria. It shows that these aspects are interconnected and influence each other, challenging the conventional separation between them in decision-making models. Particularly, the results show that the causes that trigger the decision-making process also affect the evaluation criteria applied, which goes against the classical approach (to an extent). The classical decision-making models with underlying rationality assumptions clearly distinguish the two. The results suggest that people are not good at achieving such separation.

The analysis yields two models. The first model comprises somewhat restrictive causes, and the second includes motivating reasons. The two models show two fundamentally different paths in enrollment: focusing on short-term or long-term benefits. If the causes were restrictive, it might be that the respondents seek their agency in perceiving the causes and alternatives as delivered by their assessment and not objective restrictions. Restrictive social and financial causes have the most prominent effect on choosing not to enroll in tertiary education. In addition, the often disregarded role of emotions reveals their effect on decisions and satisfaction.

An effort should be made to remove perceived barriers to continuing education regarding social and financial causes. Another way is to enhance the decision-making process by empowering high-school graduates with enough information and decision-making skills, emphasizing long-term focus. By identifying financial, social, and personal factors influencing enrollment decisions, policymakers can design strategies to remove barriers and encourage individuals to pursue higher education. The research's findings also have implications for organizations in terms of policy and strategy formulation. For example, understanding the impact of financial and social factors on decision-making in the context of higher education enrollment can help organizations design employee benefits and development programs that support employees' career aspirations and personal growth.

By examining how emotions affect the decision-making process for higher education enrollment, the study offers insights into the complex interplay between rationality and emotional factors in strategic decision-making. Strategic decision-making requires alignment with long-term goals and objectives, and the role of dominantly negative emotions in the long-term context suggests their influence in enhancing strategic orientation during decision-making processes.

This understanding can be applied to organizational settings, where managers and employees regularly face critical decisions that shape the direction and success of the organization. This knowledge is also relevant for leadership development programs, as it can help develop emotionally intelligent leaders who can manage their emotions effectively, use them as information, and make sound decisions in complex and uncertain situations. In addition, the research can be used in management education to introduce students to the complexities of decision-making in both personal and organizational contexts. By incorporating the role of emotions and subjective factors, educators can provide

students with a more comprehensive understanding of managers' decision-making challenges.

By viewing transitional choices as strategic decisions, the study provides a new perspective on understanding the long-term consequences of such decisions. By acknowledging the role of emotions, the study challenges the traditional view of rational decision-making and contributes to understanding human behavior in strategic choices. Managers often face high-stake decisions, and their emotions can impact the choices they make and the outcomes of those decisions. Understanding the role of emotions can help managers become more self-aware and make better-informed decisions.

The research acknowledges the importance of personal preferences and influences in decision-making processes. This recognition is valuable for organizations, as decisions made within a company are influenced not only by rational considerations but also by the individual motivations, values, and emotions of decision-makers. Managers can use this knowledge to foster a more inclusive decision-making process considering diverse perspectives and subjective elements.

Although the dataset is not small, further research should explore a probability sample from different regions and countries. In addition, other transitional choices (and other strategic choices) remain to be explored in future research. The sample comprised somewhat younger people than the population, which can bias the results, especially regarding the event appraisal. Further research should explore a probability sample from different regions and countries to enable additional insights and comparison. Generalizing conclusions require further study, preferably with a further questionnaire development where the relevant variables can be examined through the indicators as latent variables. While the research tackles the strategic decision-making in choosing tertiary education enrollment, other transitional choices (and other strategic choices) remain to be explored in future research.

Supplementary materials are available at: https://osf.io/c5yth/?view_only=26c91abb622749e588c3b5abbc281c32

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Primary Paper Section: A

Secondary Paper Section: BB

Appendix:

Table A.1 HTMT values in the first model

	NEMO	PEMO	SAT	AE	D	CT
NEMO						
PEMO	0.170					
SAT	0.661	0.467				
AE	0.367	0.077	0.433			
D	0.535	0.175	0.586	0.606		
CT	0.443	0.169	0.524	0.400	0.625	
CV	0.087	0.084	0.140	0.123	0.193	0.169

Table A.2 HTMT values in the second model

	NEMO	PEMO	SAT	AE
NEMO				
PEMO	0.170			
SAT	0.661	0.467		
AE	0.367	0.077	0.433	
D	0.535	0.175	0.586	0.606

PRICE DYNAMICS OF GOLD AND SILVER IN THE PERIOD 2015-2023

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Abstract: The aim of this paper was to map the price development of selected metal commodities - gold and silver from 1 January 2015 to 1 January 2023, to determine whether the COVID-19 pandemic had an impact on their price development and whether there is a linear relationship between the prices of these commodities. The validity of the correlation between the prices of gold and silver was examined using correlation analysis. Granger causality confirmed a statistically significant relationship between past gold and silver prices, indicating their mutual predictive value for future prices. The price data was obtained by content analysis and evaluated by graphical analysis. During the period under review, the price of both commodities increased, and the curves of both commodities followed a similar pattern. The gold price evolved from the original value of CZK 877.19/g to the price quoted on 1 January 2023, which was CZK 1,327/g. The price of silver also saw a price development, from CZK 11.64/g to CZK 17.43/g. From an investment point of view, the COVID-19 pandemic had a positive effect on both commodities, as prices increased significantly, especially for gold, which can serve as an investment metal in times of economic crises. The biggest limitation of the work were events such as the COVID-19 and the war in Ukraine, which influenced the price development of both commodities and thus could have affected the results of the research.

Keywords: Gold, silver, correlation analysis, price development, COVID-19 pandemic.

1 Introduction

Commodities have long been considered an outsider in the investment world, often for a good reason. Unlike shares, commodities do not offer the so-called market's beta. In contrast, they represent a set of unique price returns reflecting the underlying dynamics of supply and demand for tangible assets that serve as a building block of the global economy [1]. The literature describes a significant relationship between commodity prices and their futures and macroeconomic variables, which indicates the important role commodities play in the real economy [2]. Commodity futures contracts originated as a form of agricultural insurance and were primarily used for the stabilization of commodity prices [3]. Generally, the actual price of globally traded commodities is determined by supply and demand. One of the major factors determining the actual price of commodities is changes in demand for commodities associated with unexpected fluctuations in global real economic activity [4]. Given that the supply of commodities is vital to modern society, fluctuations in commodity prices can significantly affect the functioning and sustainable development of macroeconomy, manufacturing activities, and people's safety and well-being. The commodity market also plays a key role in international industrial chain and sustainable development [5]. Price jumps in commodity markets are rare and extreme events occur less often than in stock markets. However, the correlation of jumps between commodities can be high depending on the commodity sectors. Energy, metal, and grain commodities show high jump correlations [6]. The global spread of the COVID-19 epidemic caused upheaval in the world financial system, prompting an urgent need to reassess gold as a secure haven for finances [7].

The objective of the paper is to map the development of selected metal commodity prices, specifically, gold and silver, in the period 1 January 2015 – 1 January 2023, to determine possible impact of the COVID-19 pandemic on the development of their prices, and to find out whether there is a linear relationship between the commodity prices. To achieve the objective set, the following research questions are formulated:

By answering this research question, it is possible to determine the development of gold and silver prices over the last eight years. The data are then used to answer RQ3.

RQ1: How did the gold and silver prices evolve in the years 2015-2023?

The question will be answered using the comparison of gold and silver prices in the period 1 January 2019 – 1 January 2023. The COVID-19 epidemic was declared pandemic by the WHO on 30 January 2020. By comparing the development of prices in this period, it is possible to determine the impact of the pandemic on the development of individual commodities.

RQ2: What was the impact of the COVID-19 pandemic on the development of the gold and silver prices?

By answering this research question, it will be possible to determine whether there is a relationship between the price of gold and silver, i.e., how the price of one commodity influences the price of the second one.

RQ3: Is there a linear relationship between the prices of gold and silver?

2 Literary research

Resistance to corrosion, rarity, and value represent basic properties that make gold a suitable medium of exchange in the financial and business sphere. Gold is a safe way to store funds in the case of a financial crisis or instability and volatility in world markets. What is even more important is the fact that it is used as an economic benchmark for the global economy and will continue to play an important role in the global economy [8]. Besides buying and selling gold physically, some markets also enable electronic gold trading [9]. The movement of prices of gold as the preferred investment tool is gaining attracting an increased attention. Compared to macroeconomic factors, financial speculation shows stronger explanatory power on changes in gold returns, because international speculative forces are becoming increasingly more active. [10].

The unique properties of silver, enable using it for many applications. [11]. As with most commodities, silver price is determined by speculations on the side of supply and demand, which makes the price of silver volatile due to a smaller market, lower market liquidity, and demand fluctuations between industrial and storage uses [12].

The impact of the COVID-19 pandemic on the price volatility is different in the case of financial assets and precious metals assets. While the infection speed, i.e., the number of people infected with COVID-19, amplify the effect on the tendency towards a high price volatility regime for S&P 500 and FTSE 100 indices, in the case of futures, the effect of the infection speed as well as the number of deaths on gold and silver is moderated, which implies that the gold and silver markets act as risk-hedging safety assets alternative to financial assets during the COVID-19 turmoil [13].

[14] used a quantile cointegration model to demonstrate the relationship between the prices of gold and silver. While cointegration models, which assume constant cointegration vector, are not able to identify cointegration relationship between the prices of gold and silver, the author proved the existence of a non-linear long-run relationship. The cointegration vector was modelled as dependent on state and varied over time. The results indicate that the significant role of precious metals as investment opportunities, especially in period of economic upheavals, leads to the interdependence of gold and silver in these periods.

[15] examined whether the role of gold changes as a result of the introduction of gold exchange-traded funds (ETF) on the basis of sample data from seven countries where physically-backed gold ETFs have been issued. The results show that the traditional role of gold really changes after the introduction of gold ETFs, especially in the corresponding stock markets. [16] delves into the volatility of silver prices post the financial crisis of 2007-2009. Using a structural vector autoregression (VAR), it aimed to examine how sensitive silver prices are to fluctuations in

macroeconomic factors and to assess the reciprocal impact between changes in these variables and silver prices. The key findings revealed that silver prices demonstrate a notable responsiveness to shifts in the gold price, trending relatively sideways. [17] uses several machine learning tree-based classifiers (bagging, stochastic gradient boosting, random forests) to predict the price direction of gold and silver exchange traded funds. [18] conducted an analysis that used quantile regression to assess safety in the context of market volatilities in equities, gold, gold mining and silver. Their findings suggested that gold mining stocks may be an effective alternative to gold itself, as there is a negative correlation of returns between these assets. [19] indicate that people involved in financial markets should carefully consider how much of their portfolio is invested in precious metals markets, especially in the context of the bubble correlation between gold and silver, and especially in times of crisis. Correlation analysis is one of the fundamental mathematical tools to identify the dependence between classes [20]. This type of analysis was used by [21] to identify processes and analyse.

Using the Granger causality test in different parts of the value distribution, [22] confirmed the protective role of precious metals (such as gold, platinum and silver) against risks associated with political relations between China and the United States. The results of the Granger test suggest a mutual causality between current and future returns on gold, silver and their futures [23]. [24] presents empirical evidence regarding the relationship between the gold price and stock market price indices over the period from January 2010 to December 2016. This evidence was obtained using Johansen's cointegration test and Granger causality test.

Secondary data analysis can be a benefit for advanced academic researchers, as it provides large data samples and various data on multiple topics [25]. Qualitative content analysis is a research method conducted either inductively or deductively [24] Quantitative information represent "hard" data, which are considered more persuasive than qualitative data [26]. The purpose of the content analysis/Purpose content analysis is a methodology used in many academic disciplines as a tool to obtain quantitative measures from textual information. Content analysis can be used for data mining and is useful in examining a wide variety of data, including textual, image, and audio datasets [27].

Data collection in the research will involve content analysis, and relationship will be examined using a non-parametric correlation coefficient. Subsequently, cointegration analysis will be conducted using Johansen's cointegration test and Granger causality test.

3 Methods and Data

For the purposes of this paper, content analysis is primarily used for secondary data collection. The findings are analysed using correlation analysis, graphical analysis, and comparative analysis, which will enable answering all the research questions formulated.

The first research question will be answered using the content analysis, which will analyse data obtained from the Kurzy.cz [28] website and the Czech Statistical Office (ČSÚ, 2023). The period under study is 1 January 2015 – 1 January 2023. Data will be monitored at the beginning of each month and recorded in an MS Excel spreadsheet. The subject of each observation is the gold price in individual years in CZK/g. The obtained data are then graphically processed and used for answering the third research question.

Data necessary for answering the second research question are analysed using quantitative content analysis based on the data obtained from the Czech Statistical Office (ČSÚ, 2023) and Kurzy.cz (Kurzy.cz, 2023). There will be monitored the development of the prices of gold and silver in the period 1 January 2019 – 1 January 2023 and subsequently, both trends will be compared. Data will be monitored at the end of each

month and recorded in an MS Excel spreadsheet. The monitored period is selected so that it covered the year before the outbreak of the COVID-19, the year in which the pandemic started, and the period after the massive spread of the virus stopped. These results enable understanding the impact of the COVID-19 pandemic on the development of both metal commodities' prices.

To be able to answer the third research question, data obtained to answer the first research question. Correlation analysis with the help of Kendall's Tau B and Spearman correlation coefficient will be used to confirm possible existence of the linear relationship between the prices of gold and silver. This is a sample correlation coefficient, which can be calculated as follows:

Kendall's Tau is calculated using the formula below [29]:

$$\text{Kendall's Tau B} = \frac{n_c - n_d}{n(n-1)/2} \quad (1)$$

Where:

n_c number of concordant pairs

n_d number of discordant pairs

n number of samples

Spearman correlation coefficient is calculated using the formula below [29]:

$$r_s = 1 - \frac{6 \sum_{i=1}^n (r_{Xi} - r_{Yi})^2}{n(n^2 - 1)} \quad (2)$$

Where:

n is the number of values in samples X and Y

r_{Xi} order of i -th value in sample X

r_{Yi} order of i -th value in sample Y

If the correlation coefficient equals zero, there is no linear dependence between the variables. Positive values indicate a directly proportional relationship, i.e., the price of one commodity grows with the rising price of the second commodity. Negative values suggest an indirectly proportional relationship, i.e., the price of one commodity decreases with a rising price of the second commodity. The closer the value of the correlation coefficient is to one or minus one, the stronger the linear relationship is. The chosen significance level α is 5 %.

Granger causality will be applied to identify and analyse the relationship between the evolution of silver and gold in a time sequence of data. This test will allow to assess whether the past values of one metal can predict the current or future values of the other metal.

To determine Granger causality between two variables X and Y , regression models are used:

$$Y_t = a + \sum_{i=1}^p \beta_i Y_{t-i} + \sum_{j=1}^q \gamma_j X_{t-j} + \varepsilon_t \quad (3)$$

$$Y_t = a' + \sum_{i=1}^p \beta'_i Y_{t-i} + \sum_{j=1}^q \gamma'_j X_{t-j} + \sum_{k=1}^r \delta_k Y_{t-k} + \sum_{i=1}^s \eta_i X_{t-i} + \varepsilon'_t \quad (4)$$

Where:

y_t is the value of variable Y at time t

Δy_t is the change in the value of variable Y at time t

x_{t-i} is the value of variable X at time $t-i$

a are intercepts (initial values) in regression models.

β_i are coefficients for past values Y in the first and second regression models

γ_j are coefficients for past values X in both models.

p, q, r, s are the delays (time intervals) used for past X and Y values in the models

ε_t random errors are unexplained patterns

The Johansen cointegration test will be used to analyse the long-run relationships between time series (gold and silver). This test will be used to determine the number of cointegration

relationships between multiple variables. Cointegration is a concept that describes that although individual variables may move independently in the long run, there is a long-run equilibrium relationship between them.

It can be expressed as a p -th order VAR (Vector Autoregression) model for k time series Y_t , as:

$$Y_t = \Pi Y_{t-1} + \varepsilon_t \quad (5)$$

Where:

Y_t is vector of time series

Π is a coefficient matrix

ε_t is an error vector

The Johansen test is then carried out using eigenvalue analysis of the matrix Π . The testing consists of estimating the eigenvalues of matrix Π and determining how many of them are statistically significant. If there are r eigenvalues that are statistically significant, then there are said to be r cointegrating vectors. To verify the normality of the data, it is necessary to refute or confirm the formulated null hypothesis, for which an alternative hypothesis is formulated as follows.

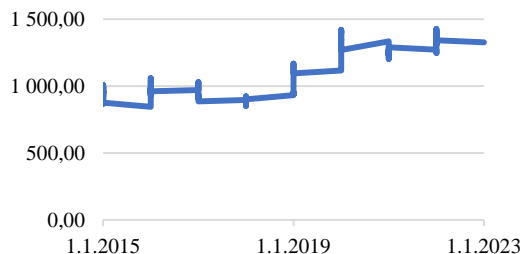
H_0 : There is a linear relationship between the prices of gold and silver.

H_1 : There is no linear relationship between the prices of gold and silver.

4 Results

Data on the prices of both commodities were monitored always on the first day of each month. A table showing the prices of gold and silver in the monitored period is presented in the appendix.

Graph 1. Trend of gold prices in [CZK/g]



(Source: Authors according to Kurzy.cz, 2023)

Graph 1 shows the trend of the gold price in the period 1 January 2015 – 1 January 2023. The data about the prices of this commodity were obtained from the Kurzy.cz website and are given in CZK/gram. The maximum gold price was recorded in March 2022. From 2015, the price of gold grew by approx. 51 %. In the period 1 January 2015 – 1 February 2015, one of the biggest price jumps in the gold price was recorded, specifically, an increase of approximately 15 % compared to the preceding month; between 1 February 2022 – 1 March 2022, the increase was about 14.5 %.

Graph 2. Trend of silver prices in [CZK/g]

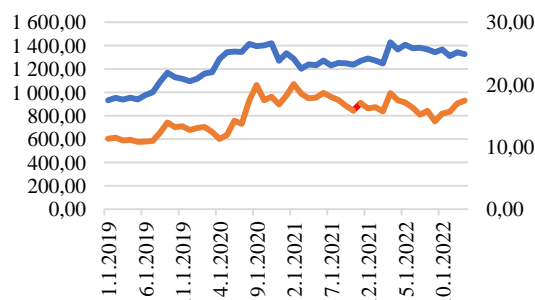


(Source: Authors according to Kurzy.cz, 2023)

Graph 2 shows the development of the silver prices between 1 January 2015 and 1 January 2023. The data about the prices of this commodity were obtained from the Kurzy.cz website and are given CZK/gram. As seen in the graph, the maximum price was recorded in February 2021. From the year 2015, the price of silver grew by about 50 %.

Graph 3. The impact of COVID-19 pandemic on commodity prices [CZK/g]

(Source: Authors according to Kurzy.cz, 2023)



Legend: Blue – price of gold (CZK/g); Orange – price of silver CZK/g)

Graph 3 shows the impact of the COVID-19 pandemic on the prices of gold and silver. The monitored period covers the year before the pandemic, during the peak of the pandemic (declared by the WHO on 30 January 2020), and the period until the beginning of 2023, when the COVID-19 virus and its mutation were still active, but the number of infected people fell sharply, and the pandemic crisis was on the wane. As seen in the graph, the situation had an impact on the prices of both commodities. The development of gold prices showed a gradual growth without any significant price jumps; however, considerable fluctuations could be observed. Within the monitored period, the price of gold rose from the initial 877,19 CZK/g to 1,327 CZK/g on 1 January 2023, while the price of silver rose from 11,31 CZK/g to 17,43 CZK/g. The results thus confirm that the COVID-19 pandemic had an impact on the development of the gold and silver prices. In times of crisis, gold serves as a hedging investment metal, as its value increases during global crises.

Table 1. The results of the correlation according to Kendall's Tau - B

	gold	silver
Gold	1	
silver	0.61	1

(Source: Authors according to Kurzy.cz, 2023)

According to Table 1, the calculation of the dependency using Kendall's Tau - B correlation coefficient resulted in 0.61, which falls within the boundary between moderate and strong linear dependence.

Table 2. The results of the correlation according to Spearman correlation coefficient:

	gold	silver
Gold	1	
silver	0.8	1

(Source: Authors according to Kurzy.cz, 2023)

Using Spearman's correlation coefficient yielded a value of 0.8, indicating a strong linear dependence, as presented in Table 2. The calculations were conducted at a significance level of 5 % and are statistically significant.

Figure 1 Granger causality test for silver

```

Model 1: vilda_test$gold ~ Lags(vilda_test$gold, 1:3) + Lags(vilda_test$silver, 1:3)
Model 2: vilda_test$gold ~ Lags(vilda_test$gold, 1:3)
Res.Df Df      F      Pr(>F)
1      87
2      90 -3 5.68042 0.0013375 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 ''

```

(Source: Authors according to Kurzy.cz, 2023)

The result of the Granger causality for silver is 0.013375, computation was performed using Lags = 3, as shown in Figure 1. The results reach values below 0.05, which represents the set significance level for statistical analysis.

Figure 2 Granger causality test for gold

```

Model 1: vilda_test$silver ~ Lags(vilda_test$silver, 1:3) + Lags(vilda_test$gold, 1:3)
Model 2: vilda_test$silver ~ Lags(vilda_test$silver, 1:3)
Res.Df Df      F      Pr(>F)
1      87
2      90 -3 4.48313 0.0056478 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 ''

```

(Source: Authors according to Kurzy.cz, 2023)

The Granger causality result for gold is 0.0056478. This value indicates a statistically significant relationship between past values of another variable and the price of gold. In the context of Granger causality, this result indicates the existence of a statistically significant causal relationship. The results confirm the null hypothesis and do not support the acceptance of the alternative hypothesis.

H0: There is a linear relationship between the prices of gold and silver.

Figure 3 Johansen's cointegration test

```

#####
# Johansen-Procedure #
#####

```

Test type: trace statistic , with linear trend

Eigenvalues (lambda):

[1] 0.1643804997792476 0.0172509125744634

Values of teststatistic and critical values of test:

```

          test 10pct 5pct 1pct
r <= 1 | 1.64  6.50  8.18 11.65
r = 0  | 18.52 15.66 17.95 23.52

```

(Source: Authors according to Kurzy.cz, 2023)

The result of the Johansen cointegration test showed that the cointegration vector (r) that was plotted exceeded the specified significance level. This result indicates the existence of one cointegration vector among the variables under study. This can certainly be seen in the calculation shown in Figure 3.

5 Discussion

Based on the results obtained, it is possible to answer the research questions:

RQ1: How did the price of gold and silver evolve in the last eight years?

The data needed to answer this research question were obtained using a content analysis and processed and evaluated using a

graphical analysis. At the beginning of the monitored period, the price of gold was 877, 19 CZK/g. From the year 2015, the price of gold rose by approx. 51 %. The maximum price (1,428,29 CZK/g) was recorded in March 2022. In the period 1 January 2015 – 1 February 2015, one of the biggest price jumps was recorded of approx. 15 %. Another large fluctuation was recorded between 1 February 2022 and 1 March 2022 (a rise by about 14.5 %). The price of silver was 11,64 CZK/g at the beginning of the monitored period. From the year 2015, the price of silver rose by approximately 50 %, with the maximum price being recorded in 2021, reaching the value of 20,8 CZK/g. The results thus indicate a similar price development of both commodities.

The price of gold can be affected by inflation because gold is often seen as a safe investment and storage value in times of economic uncertainty or in periods when inflation is rising. When inflation rises, the value of money falls, which may encourage investors to seek assets that hold their value better than traditional currencies this is also confirmed [30] in their work. Gold is considered an "inflation hedging" instrument because its value historically increases during periods of high inflation, offering protection against a decline in the purchasing power of the currency.

RQ2: What was the impact of the COVID-19 pandemic on the development of the gold and silver prices?

The results show that this situation affected the price development of both commodities. The COVID-19 pandemic had a significant impact on the gold price. During the period of uncertainty and economic turmoil caused by the pandemic, investors looked for safe assets and resorted to traditional havens such as gold. During the pandemic, investors favoured assets with less risk, which led to a growing demand for gold and a subsequent increase in its price. This phenomenon is a typical example of how instability in the global economic environment can affect investor behaviour and cause a shift in the price of commodities such as gold.

[13] examined the impact of the COVID-19 pandemic on the volatility of financial assets and metal prices. The findings of the author are thus in line with the findings resulting from the presented research, stating that from the perspective of investment, the COVID-19 pandemic had a positive impact on the price development of these commodities, which can thus be considered hedging assets and alternatives to financial assets in times of economic crises.

RQ3: Is there a linear relationship between the prices of gold and silver?

The value of the correlation coefficient obtained through a correlation analysis were 0,61 (Kendall) and 0.80 (Spearman) after rounding. It can thus be concluded that there is a very strong linear dependence between the prices of gold and silver. If the value of one variable increases, the value of the other variable rises as well. The significance level, which was set at 5 %, is lower than the value of the correlation coefficient; therefore, the alternative hypothesis H1 is rejected and the null hypothesis H0, stating that there is a linear relationship between the prices of gold and silver, is accepted.

In his study, [14] used a quantile cointegration model to prove the relationship between the prices of gold and silver. The authors agree with the finding that there is a relationship between these two commodities, especially in the periods of economic turmoil.

Based on the proven Granger causality, it can be assumed that information about the price of gold can be derived from silver values and vice versa. This statistical test shows the possible predictive power of past silver values in predicting future gold prices and vice versa. Such correlations between gold and silver prices may be due to several factors. These include the more common use of both metals as investment tools in the search for safe assets in times of economic uncertainty.

6 Conclusion

The objective of the paper was to map the development of the selected metal commodities – gold and silver between 1 January 2015 and 1 January 2023, to determine whether the COVID-19 pandemic had any impact on the development of their prices, and whether there is a linear relationship between the prices of these two commodities. The objective of the paper was achieved.

The price of both metal commodities rose in the monitored period. At its beginning, the price of gold was 877,19 CZK/g, while the final price was 1,327 CZK/g. Similarly, the price of silver grew as well in the monitored period, rising from the initial value of 11,64 CZK/g to 17,43 CZK/g. The curves of both commodities showed a similar trend.

Furthermore, it was found that the COVID-19 pandemic affected the price development of both commodities. Its influence was positive from the perspective of investment, as the prices of both commodities grew significantly. Before the pandemic, the price of gold ranged between 932,79 – 1 095,15 CZK/g, while the price of silver was between 11,31 and 12,69 CZK/g. After the end of the peak of the COVID-19, the price of gold was about 1,327 CZK/g and the price of silver about 17,43 CZK/g. This implies that mainly gold can serve as an investment metal in times of economic crises.

The results of the correlation analysis confirmed the existence of a linear relationship between the prices of gold and silver. The value of the correlation coefficient equals 0,61 (Kendall) and 0.80 (Spearman) after rounding, which indicates a very strong linear dependence. In practice, a positive correlation coefficient means that if the price of one commodity increases, the price of the other commodity will grow as well and vice versa.

The biggest limitation of this research was the COVID-19 pandemic and the war in Ukraine. These two events influenced the development of both commodities' prices and were thus reflected in the research results. The correlation between the prices of gold and silver may be the result of various factors, including their role as investment instruments in periods of economic instability, when investors seek safe haven in one of the metals depending on the market situation. This highlights the complexity of the interactions between these commodities and demonstrates their importance as indicators of market sentiment during periods of economic volatility.

A recommendation for further research is to collect the data again after the effects of the global crisis have subsided and to make new calculations and compare whether the results will match. Furthermore, it is recommended to increase the frequency of data collecting, i.e., collect data not only at the beginning of each month. With a higher frequency, more accurate results could be obtained.

The findings could be used also for predicting the future development of the gold and silver prices.

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PSYCHOTHERAPEUTIC PRACTICES AND SOCIAL WORK PROFESSIONAL IDENTITY: SYNERGY OR BOUNDARY DISRUPTION? PRACTICE IN THE CZECH REPUBLIC

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Abstract: This constructivist study aimed to explore how mental health social workers construct and reinterpret their professional identity by integrating psychotherapeutic practices into their practice in the Czech Republic. Respondents agree that social work with people with mental disorders is an area where social work and psychotherapy intersect, and the therapeutic action of the social worker is perceived as a given. Completing therapeutic training affects the construction of professional identity in different ways. Social workers with training think more broadly about their professional identity and either lean towards the identity of a therapist or feel themselves to be both social workers and therapists. The professional identity of social workers is shaped by many factors, including completing psychotherapeutic training.

Keywords: Social work, Psychotherapy, Social Work Identity, Interdisciplinary boundaries

1 Introduction

Mental health and its relevance to the social functioning of individuals is a crucial area of interest for social workers, and their professional role often involves psychotherapeutic approaches. Although in the Czech Republic there is a formal emphasis on the distinction between social work and psychotherapy as two autonomous helping professions, in practice, there can be interdisciplinary overlap, particularly in the care of people with mental illness. In this study, we aim to answer the research question: How do mental health social workers construct and reinterpret their professional identity by integrating psychotherapeutic practices into their practice? We base our study on the assumptions of social constructivism, which we apply to form social work professional identity (Navrátil, 1998). The literature and practice suggest that practical social work with people with mental illness can be supported by the therapeutic influence of the social worker (Mátl, 2019; Šupa, 2017; Tartakovsky, 2016).

When a social worker perceives a client's mental health and well-being as a fundamental factor in their social functioning, they use a therapeutic approach (Payne, 2016). According to the Center for the Advancement of Mental Health Care (CRPDZ, 2017), the cornerstone of care for people with mental disorders is psychosocial intervention, or that intervention in which the helping professional uses social and psychological management strategies and techniques that are aimed at alleviating cognitive, social, and psychological impairments.

The existing literature needs to include more information on social workers' perceptions of their professional identity in the context of psychotherapy training and its impact on their everyday practice. Therefore, this study explores how psychotherapeutic training influences social work with clients with mental illness and how social workers perceive this influence regarding their professional identity. The relationship between social work and psychotherapy is widely discussed, especially in Anglo-Saxon countries where social workers often act more as therapists (Lieberman, 1987; Thompson, 1997; Goldstein, 2009). In the Czech environment, the discussion has been absent until recently.

In the theoretical part of the article, we will focus on social work with clients with mental illness, the professional tools of social workers, psychotherapy and psychotherapeutic training, and the relationship between social work and psychotherapy. Our study contributes to an essential debate about the role of psychotherapeutic practices in social work and their impact on

the professional identity of social workers, thus offering new perspectives and insights for the professional community.

2 Theoretical part

2.1 Social work and the professional identity of the social worker

Despite the possible disapproval of the majority of society, social work is seen as the profession of the future (Papadopoulos, Egan; 2023). For example, Hanuš (2007) portrays social workers as the connective tissue of society, contributing to the bonding of individuals with the community and professionals within a multidisciplinary team. However, a unified Czech definition of social work does not yet exist. The generally accepted criterion for social work in the Czech Republic is a qualification in the form of higher professional education or university education in social work or its related fields (Act No. 108/2006 Coll.). A defining feature that can help us in our efforts to understand the nature of social work is collective identity. According to Berger and Luckmann (1999), identity is the cornerstone of each individual's subjective reality and is formed within social processes. Thus, according to several authors, social work is a socially constructed reality shaped by interactions with clients, educational and social institutions, employers, and other vital actors (Navrátil, 1998; 2015). Social work is thus seen as a socially constructed activity that can be viewed in relation to the social and cultural context in which it was created (Payne, 2016), serving as a response to specific problems in a given context. Fook (2016) builds on this idea and emphasizes that it is imperative to link context and individual experience. It can therefore be assumed that interaction with another profession (represented by participation in psychotherapy training or the use of psychotherapeutic resources) and its representatives will influence and transform (re-construct) the social worker's identity. According to Musil (2013:512), the identity of the social work field is "the collective self-concept of a group of people who find it desirable to pursue goals while acting in ways specific to social work."

For this research, we work with a definition that emphasizes the core characteristics of professional occupational identity and places emphasis on occupational self-concept (Beijaard et al., 2004). In this process, personal interests, experiences, values, and beliefs regarding the occupational self are reflected in relation to the situational or contextual aspects of work. There is also an emphasis on how social work is presented within the sector and to people outside the sector (Adams et al., 2006).

2.2 The relationship between social work and psychotherapy

Social work considers social and psychological, biological, and spiritual factors when intervening with clients. Thus, it uses knowledge from other disciplines and integrates them into its knowledge base to ensure that the interventions provided are effective (Janebová, 2014). Payne (2006) states that social work is a practice that uses psychological and social sciences, especially in interpersonal interactions with people from deprived groups. Social work with people with mental illness is integral to Czech social work. According to the National Health Information Portal (NHIP, 2023), the total number of people suffering from psychiatric illness in the Czech Republic increased by 22% between 2010 and 2021. Serious psychotic illness was the third most commonly diagnosed disorder in 2020 (NHIP, 2020). Thus, a client with some form of mental illness may be encountered by social workers across a variety of social services.

In the Czech environment, the relationship between social work and psychotherapy has not been addressed in empirical or even theoretical studies for a long time. The need for social workers to use psychotherapeutic tools precisely in the context of work with

disadvantaged children has recently been pointed out by some authors (Navrátilová et al., 2023, 2021; Punová et al., 2020), but even these studies do not focus directly on the interaction, boundaries or intersection of psychotherapy and social work. The interest in exploring the relationship between psychotherapy and social work in mental health has been significantly influenced by systemic change in the form of the Mental Health Care Reform (2017), where the intersection of health and social work is fully manifested and addressed. The social worker is a pivotal link in multidisciplinary teams and often acts as a case manager. To some extent, negotiating roles and boundaries becomes necessary (Psychiatrická společnost, 2017). Social workers may also already attend, for example, the Ministry-accredited course Psychotherapy and Social Work – Intersections, Differences and Possibilities for Collaboration, where participants are expected to learn how overcome fears of venturing into more serious topics in conversation with a client, lest they do something they do not feel competent to do (MPSV, 2022). At some universities, students can now study the new course Applied Psychotherapy and Innovation in Social Work, which promises to teach graduates to apply psychotherapy in their work, emphasizing the care of people with mental illness (e.g., CMTF, 2023). The intersection and interrelationship of the two disciplines are thus becoming more prevalent in mainstream and lifelong social work education and need to be considered more than ever before.

The relationship between social work and psychotherapy is discussed in detail by Wakefield (1988a, 1988b, 1998). Although these are older texts, the author refers to the American environment, where clinical social work (as psychotherapeutically profiled social work is called in the USA) is in a different position than in the Czech context. The author's typology is transferable to the debate about the relationship between social work and psychotherapy in the Czech environment. Wakefield (1988a) notes that social work has become one of the helping professions in the USA that is dedicated to people with mental illness. He reflects on how the widespread practice of psychotherapy affects the nature of social work. He describes three possible ways how the relationship between the two professions exists. We will loosely refer to these as 1/ the independent model, 2/ the subdomain model, and 3/ the selective model.

Within the independent model, there is no natural conceptual line between social work and psychotherapy – the use of psychotherapy by social workers may be a “historical mistake” where social workers have sought professional recognition and power outside their natural profession. In this conception, psychotherapy may be used to some extent by social workers in their work with people with mental illness (as long as it is consistent with the needs of the client), but it is still an act that lies outside the boundaries of social work.

Within the subdomain model, all psychotherapy should be conceptualized as a subdomain of social work – this requires either defining social work very broadly to include all interpersonal help, or constructing psychotherapy to fit the understanding of social work. This strategy would likely lead to an unreasonable expansion of meanings and concepts, which would be less desirable. In particular, this idea is counter-intuitive to the idea that we can intuitively say there is any difference between social work and psychotherapy. Applying this concept to our work, psychotherapists would be social workers' colleagues in the unified social work field.

In the selective model, certain forms of psychotherapy fall within the social work profession, and others do not; as such, two fundamental problems arise from this conception, according to Wakefield (1988). The first is the fact that there is a need to establish decisive criteria to determine when a technique is psychotherapy and when it is social work. Therefore, capturing the essential difference between social work and other therapeutic disciplines is necessary. The second problem is how to treat the fact that social workers are legitimately involved in

working with people with mental illness and in their psychotherapeutic treatment.

2.3 Psychotherapy and psychotherapeutic training

In the past, psychotherapy belonged more to the medical field, but it was possible to practice it outside the medical field. In the healthcare field, psychotherapy is regulated very lightly, which is still more than in the non-healthcare field, where the regulation of psychotherapy is absent. This corresponds to the current climate in psychotherapy, where two differently-minded camps are pitted against each other: the Czech Psychotherapy Society of the Jan E. Purkyně Society (ČPTS) and the Czech Association for Psychotherapy (ČAP). The ČPTS considers the only legal provision of psychotherapy to be that which can be found in a clinical psychologist or psychiatrist working as a health care provider registered by a regional authority (ČPTS, 2022). The ČAP is more benevolent and leans towards the idea that psychotherapy can be provided as a separate profession, utterly independent of the departments (ČAP, 2022). This context also influences the interprofessional collaboration between psychotherapy and social work. However, above all, opinions differ diametrically on the topic of the identity of the social worker after completing accredited psychotherapy training. Representatives of the ČPTS do not recognize that persons outside the health sector have completed such training and practice psychotherapy.

Psychotherapeutic training can be considered a crucial part of the education of future psychotherapists. It is not easy to compare or generalize between different pieces of training, as they differ not only in theoretical orientation and ideology but also in the length and content of the training itself (Rønnestad, Ladany, 2006). According to the official system of the Ministry of Labour and Social Affairs, the completion of accredited psychotherapy training is an essential part of a psychotherapist's professional credentials. Even a person without previous medical training can do psychotherapeutic training; thus, after completing it, he or she can practice psychotherapy. There is a plethora of psychotherapeutic training, which is also related to many new psychotherapeutic directions, which are increasing every year. Since this paper does not aim to describe the variety of PST (psychotherapeutic) training, we will not devote additional space to it.

Regarding the constructivist interpretation, social interactions, experiences, and sociocultural context all influence a social worker's professional identity. Thus, psychotherapy training may significantly impact the professional identity of a social worker cooperating with persons with mental illness. We anticipate a set of possible specific impacts that the completion of psychotherapy training could have, which could manifest in the reconstruction of professional identity.

3 Methodology

We will now attempt to briefly describe the essential procedures we will use in our investigation and relate them to the object of study, which is “the professional identity of the social worker after (or without) psychotherapy training.” We will choose a qualitative research strategy because we want to a) understand the specific subjective experience of individuals, b) find out how social/organizational/cultural factors influence this experience, and c) see how this experience affects the interaction between the individual and the environment (Creswell, 2013; Merriam 2009:5,13)

In this research, we investigate the perceptions of selected social workers about using PST techniques in their work with people with mental illness. We will therefore draw on the understanding method, within which we will lean towards an inductive way of thinking. Based on this, we will draw out the more regular patterns we can extract from the data. We lean towards induction because the topic of “social worker identity with and without PST training” is not covered in the literature, so there is no theoretical framework through which we can view our research.

Unlike inference, we will begin our research with as few perceptions as possible so that a theory can emerge from the data (O'Reilly, 2012). Given this, we lean towards grounded theory, an inductive primary qualitative research method. Thus, the main task of the researcher is to discover what is in and behind the data. The orientation toward generating theoretical ideas (hypotheses) from the data is essential (Strauss, Corbin, 1998). For us, the central concept of perception will be based on constructivist theories of social perception; thus, the researcher leans towards Charmaz's (2014) constructivist grounded theory methodology. According to Charmaz, the researcher does not assume any external truth to be discovered; instead, the emphasis is on the dynamic and reciprocal interaction with the research participants, with the truth being formed in the process (Charmaz, 2008, 2014).

Respondents were contacted by email to check whether they met all the criteria we had set. Three respondents were contacted through the snowball method, as we were contacted by the respondents we interviewed initially. We outlined the main objectives of our work to the respondents by email. Before the interview, we ascertained demographic information (field of study, length of experience, type of training, organization, and age). Interviews (and repeat interviews) were recorded, and respondents were made aware of this and consented to the recording. In total, we worked with eight respondents, all of whom were social workers. The respondents with training were required to have completed accredited (and multi-year) PST training.

Tab. 1: Basic information about respondents

	SEX/ AGE	EDU CAT ION	PROFE SSION	PST TRAI NING	TYPE OF TRAI NING	REP EAT ED INT ERV IEW
R 1	W/3 2	mast er's	SW	YES	Dasein	YES
R 2	W /35	bach elor's	SW	YES	CBT	YES
R 3	M/27	mast er's	SW	YES	Gestalt	NO
R 4	W /36	mast er's	SW	YES	CBT	NO
R 5	W /30	colle ge	SW	NO	-	YES
R 6	W /27	bach elor's	SW	NO	-	YES
R 7	W /31	mast er's	SW	NO	-	NO
R 8	M /28	colle ge	SW	NO	-	YES

Source: Authors

3.1 Data analysis process

After completing all the interviews, the main task was to transcribe them verbatim after each session. According to Hendl (2016), transcription allows for delineating similarities in the content communicated by the respondent. Based on Charmaz's recommendation, we analysed each interview immediately so we had a vivid memory of the non-verbal communication and the context of expression. After almost every interview, we determined a range of topics we wanted to discuss further with the respondents as part of the data saturation process. For five of the respondents, we used the option of a supplementary semi-structured interview; for three, we repeated the supplementary semi-structured interviews twice. Four respondents were recruited through social media advertisements, while the rest of the respondents were recruited through the snowball sampling method. We conducted 16 interviews with eight respondents, ranging from 25 minutes (for the repeated one) to 98 minutes.

Thus, in analyzing the collected data, we followed the guidelines formulated by Charmaz (2008, 2014). Following Charmaz (2014), we ensured that coding consisted of initiation and selection phases. The initiation phase is characterized by the researcher's attempt to name and code information to create space for the diverse interpretations and meanings perceived in the data. In the selective phase, we searched for units of meaning and significance, sorted the codes, and sought to integrate and synthesize the data. Thus, using focused coding, the codes are grouped into similar categories, which are described by Charmaz (2014: 91-92) as "the refinement of ideas, events, and processes in our data." The aim is also to uncover the relationships between the coded parts. Axial coding (Charmaz & Henwood, 2008) is characterized by identifying categories, their dimensions, and internal structures.

4 Results

The identified categories related to the immediate experiences and attitudes of the respondents that they associated with the construction of their professional social work identity. This analysis aimed to understand respondents' subjective meanings and study how they directly construct these meanings (Charmaz, 2014). As there were responses from multiple respondents in the interviews, each statement will be numbered based on which respondent the statement belonged to (table in methodology). For clarity, verbatim quotations are provided and are italicized in the text. Due to limited space, we present the interpretation of one category.

4.1 Professional identity through the eyes of social workers in the care of people with mental disorders

All respondents perceive social work as an autonomous profession distinct from other helping professions.

Concerning the professional identity of the social worker, respondents R5 and R8 emphasized the never-ending work of the social worker. Respondents R2 and R6 emphasized that the identity of a social worker does not form itself without effort but needs to be nurtured, which was complemented by respondents R1 and R3 about the need to fight for it in society. *"Once you're a social worker, then you have to do something every day to make the profession stand out."* (R8)

A big theme concerning professional identity was education and competence. Respondent R2 spoke mainly about lifelong learning in this context. According to respondents R6 and R7, sharing practice and experience among social workers also strengthens the identity of social work. Respondents R3 and R4 believe that social workers can only do an excellent job by continuously improving their skills and broadening their horizons in social work. In the area of training, the professional "mischief" associated with mandatory lifelong learning that occurs in some services was also repeatedly highlighted by respondents (R1, R4, R8): situations where the offer of compulsory courses does not correspond to the needs of social workers, or it is not explained why it is necessary to attend courses. In such cases, social workers attend courses only out of obligation and take nothing from them, which does not contribute to strengthening their professional identity. According to the respondents, this leads to the fact that social workers do not want to be educated; they take it as a necessary obligation and sit out the courses.

"Education - fortunately, the law requires us to do that, and that is the most important thing. However, it is not like I'm going somewhere to do the course; I'm trying to choose what interests me and is useful for my practice. There are some places and organizations where people have mandated courses, which no one is interested in, and they have it as an obligation, and no one takes anything away from it." (R5)

Synonymous with professional identity, according to respondents, were terms such as 'togetherness' (R1, R6, R7), 'meeting each other' (R5, R8), 'shared practice' (R1, R2), 'interdisciplinary collaboration' (R3, R4), 'sharing problems and experiences outside the home organisation' (R6, R7) and 'collective consciousness' (R2, R3).

"I feel it (author's note: identity) as belonging to the profession. Although, for example, according to Satir, we should not identify ourselves as social workers. But I do. The personal life, the lifelong learning, the prevention of burnout syndrome, and my well-being are also important. But for me, it's identifying with the values of social work itself." (R1) Identity was also mentioned as an entity a good social worker should care about (R1, R4, R5). According to respondents R5 and R8, identity awareness and care are central to preventing burnout syndrome. *"You want to be pretty, so you go to the hairdresser and the beautician. You want to be a good social worker who isn't burnt out and can help clients? Then you must constantly care for yourself and your professional values."* (R5)

When asked where respondents would place their professional identity, respondents without training responded consistently that it was in the social work category. They feel their own identity is in the role of a social worker. In this part of the statement, identity was thought of in terms of social and professional roles. Respondents R3 and R4 with training reflected that they needed clarification, and although they are still doing social work, therapy does intrude a lot into their intervention with clients. They are both thinking about going to work somewhere as therapists. Respondent R1 with training still refers to herself primarily as a social worker and wants to keep that the same. Respondent R2 refers to herself as a therapeutically-oriented social worker at the moment. However, in her own words, she is balancing what she wants, and although she enjoys her work as a social worker, the poor financial situation in the service where she works as a social worker is likely to drive her to therapy. She separates the field identity of social worker and the identity of psychotherapist as two parallel worlds. *"I have been in practice for many years. Identity-wise, I am more of a social worker. We'll see how it goes from here. And I think I'll be happy to say I'm a social worker - a psychotherapist, if I take it chronologically. Over the years, I've built a certain pride in being a social worker."* (R1)

Respondents also reflected on when and how the two disciplines intersect, when this is desirable and when it can be risky, and what role PST training can play. Respondents with training also shared another fact, namely their perceptions of the impact of PST training on their social work with clients. All respondents (R1, R2, R3, and R4) emphasized the tremendous value of the self-experience portion of the training. In their view, self-experience should be mandatory in the training of future social workers. *"I was greatly enriched by the experience period, which allowed me to experience and conclude things that could be reflected in my work with the client. I don't feel that I have mastered a series of techniques that I could apply to client work. Rather, it's more about that gut feeling and that internal setting. That then translates into working with the client."* (R4)

Another area that respondents perceive in relation to training is a shift in both personal and professional areas. Respondent R1 shared that the change was in how she was able to gradually break out of patterns and stereotypes in her head based on previous experience. She also sees positive impacts in her work with clients. *"It has definitely helped me in my practice because I can teach clients that way by learning to accept myself more there and with different external qualities, and not all completely one hundred pro-positive qualities so that they accept themselves better. Because I accept them better, because I'm more tolerant and patient."* (R1) None of the respondents regret having taken the training. Although it has been challenging regarding resources and balancing work, personal, and "training" life, they all feel that the training has only enriched them, and they do not regret going through it. *"I think I would have functioned worse without the training, certainly not as well. It definitely gave me some professional confidence."* (R2)

The negative aspect of a situation where a social worker has training was also reflected. The conflict between organizational and legislative matters was mentioned, whereby the nature of the social service, or social worker, lead to the feeling that they should not do psychotherapy (R2, R4). However, according to respondents R1 and R2, a social worker with psychotherapy training is an advantage, and it is about how they set up and communicate this within the service or team. Identity crisis was also mentioned, where the social worker can stop doing social work and only deal with the client's psyche (R1, R3). *"It has limits in that if a person wants to comply with the regulations badly, they don't actually use the fact that they have training in that social service. If it's important for him to help those clients, to provide that social service well and use that training that he has, so he does the psychotherapy anyway, but he can't say that anywhere."* (R1)

Respondent R4 identifies situations where a social worker with training has and can act therapeutically and does not have to fear stepping out of the social worker's identity. At the same time, however, she distinguishes between a psychotherapist and a social worker with psychotherapeutic training. *"Sure, when we have a client who needs much psychotherapy and much intensive psychotherapy, it's not that we're somehow criticizing the service, but we're just recommending psychotherapy to the client and working with them to find a therapist, start therapy and go to therapy."* (R4)

Respondent R3 highlights the benefits of completing PST training for a social worker and illustrates it by working with a client. *"... if a person has a therapeutic background and has that overlap there, then on the one hand, they can solve many problems, like mental health issues or some crisis illness or something. It's more like identifying that this might be a problem and needs to be addressed rather than someone who does not have that training."* (R3) It should be mentioned, however, that even respondents without training named situations where, in their opinion, it would be desirable for them to have psychological or therapeutic training.

Respondents R3 and R4, however, described an experience where a social worker, having received psychotherapy training, had swapped the identity of the social worker for that of the psychotherapist. *"I have known people who, after PST training, change that helping profession and become identity therapists. It makes sense to me that some people have that. It could be that working as a therapist is more prestigious and better paid."* (R3)

Respondents R6, R7 and R8 described situations where they could imagine and find it meaningful for a social worker without training to do some of the more therapeutic techniques with a client if they feel up to it. However, they stress that these must be safer, more standard techniques. For example, the social worker puts on music, and the client draws what comes to mind (R1), works with a picture of characters, identifies with one, and then talks about why (R1, R4). Respondent R7 was the most open to using psychotherapeutic techniques in social work, but she stressed that the social worker must have *"some training, the basics of crisis intervention, [and must] seek out the training oriented to this issue."* (R7)

Interdisciplinary boundaries were described in various forms by virtually all the respondents, although each viewed them slightly differently. Respondent R5 declared that psychotherapy does not belong in social work. Imaginary boundaries were often discussed concerning the education and competencies of the social worker. A social worker without psychotherapeutic training is simply a social worker who should think very carefully about therapeutic action (R2, R3, R5, R6).

Respondents with training R1, R3, and R4 compared their interventions with clients before and after training, and all agreed that completing accredited PST training had taken their social work practice up many levels. Respondent R3 said that he had never thought about it until he had undergone the training himself. However, after completing it, he feels more competent and receives positive feedback from colleagues and clients. Respondent R4 says that she can only imagine working with clients with the knowledge that the training has given her. *"Training has changed a lot my overall perception of the world. Moreover, it definitely translates into my work with clients. It may sound like a strong statement, but I can't imagine working with clients now and not having that knowledge and experience from the training."* (R4)

Most respondents are inclined to the view that, officially, psychotherapy does not belong to social work. Risks and dark scenarios were mainly mentioned by respondents with training in this area. Respondent R1 discussed the problem of the blending of the two disciplines. The respondent mentions one situation where social work and psychotherapy were blended, leading to her colleague having to leave the service. *"Until now, I had a colleague there who was a psychologist with PST training, and she also had a degree in social work, which she had never done in practice. So she was having much trouble dealing with the practical stuff in that residential service, and she was having much trouble setting boundaries and enforcing those rules that applied to the other clients or the place."* (R1)

However, respondents also acknowledge that they are sometimes more therapeutic when working with clients. However, respondent R6 says it should not be taboo in social work to let a client share something traumatic and difficult. The social worker needs to make it clear at that moment that he or she is there for the client, to listen to it, but to resist the urge to find a solution to the situation. Respondents R4 and R8 also agree with this. *"I see a difference in the work of a social worker and a therapist. SPR, we don't have a problem being with the client in those difficult situations and topics, but we say to them, "We are not going to help you process this," and "We are not going to get rid of this disease."* (R6) However, respondent R5 strictly emphasized that she could not afford to be a therapist in her work. She is therapeutic only in the sense that *"if the client opens up, shares something with me, then, of course, I listen respectfully, but that is as far as I can go because I have no training or psychological education."* (R5)

Although the respondents (R1, R2, R3, R4) have completed accredited PST training, they try to avoid getting too involved in psychotherapy or psychological interventions with clients. Respondents R3 and R4, however, recognize that they work differently with clients compared to the pre-training period, and the collaboration is deeper. Respondent R1 shared that even though she has completed the training completely, there are psychotherapeutic techniques that she would not dare to use even now, such as: *'relaxation, imagery, general bodywork, or opening up childhood themes, and I know that would be more than desirable when working with my target. I don't feel up to it yet. However, it doesn't belong in social work.'* (R1). Respondents R1 and R3 also highlighted the interesting idea that even the fact that a social worker completes their training does not entitle them to *"mindlessly use psychotherapy when working with clients in social services. Self-reflection is important."* (R3) *"But when a social worker has completed PST training, it also depends on what they have. It's all about self-reflection. If a social worker is a macho person who plays therapist, they could damage that client."* (R1)

According to the respondents, the organization's culture also influences social work and psychotherapy intermingling. Respondent R2 reflected that she found it difficult to talk about the relationship between social work and psychotherapy because their service is set up very loosely, and all social workers have either completed their training or are almost at the end of it. Despite this looseness, the respondent stands by the fact that there are boundaries between the two professions, and it cannot be pretended that they do not exist. Respondents R5 and R6, on the other hand, say that the basis of their services is social counseling, which does not include psychotherapy.

"... the relationship is very open-ended. The boundaries are looser for us, but we are aware of them. We perceive that there are boundaries between social work and psychotherapy I don't question that at all. It needs to be reflected." (R1)

5 Discussion

Some respondents mentioned several cases of people who, immediately after completing psychotherapeutic training, redefined their professional identity in favour of psychotherapy, referred to themselves only as therapists, and quit social work altogether. This is a topic that deserves more research scrutiny. We believe that the "total redefinition" of the social worker's professional identity into that of a psychotherapist may be motivated by greater social prestige, independence, and potentially higher earnings, which are fairly rational and pragmatic reasons (which are also more or less consistent with the respondents' statements). However, why someone "converts" to psychotherapy and why someone, even with a bit of training, remains a social worker is not clear from any research, and we can only guess as to whether it is personality adjustment, professional self-confidence, or the organization's culture, etc. A constructivist approach offers different perspectives that can shed light on how these decisions are shaped and how they affect the professional identity of social workers. Further research could thus focus, for example, on how social workers construct and reinterpret their professional identity by integrating psychotherapeutic practices into their practice and how these factors influence their professional roles and career paths.

Again, this is a shared subjective construction of the selected respondents, and the aim is not to generalize the findings to the broader population. It is clear from the respondents' accounts, and their perceptions of the whole issue, that completing PST training impacts the construction of a social worker's professional identity.

Respondents with training perceived the impact of completing the training on interventions with clients mainly regarding their professional self-esteem and their ability to understand the client's situation more comprehensively. However, respondents also accentuate greater social prestige and financial reward if they become therapists, which two of them openly thought about. Sometimes, the social worker becomes more "professional" (hence more professionally confident) and uses the skills acquired from the training adeptly in their daily work with clients. At the same time, the self-experience allows them to be more congruent and authentic. The role of self-experience and the identification of personal themes were repeatedly emphasized, which, thanks to the training, social workers were able to process on their own in a safe environment and could avoid uncomfortable situations when working with clients where the worker's unprocessed theme would be encountered. Respondents with training were also much more likely to emphasize the need to follow up with professional therapeutic help and knowledge of the main manifestations of mental illness in client crises.

Respondents without training admit that there is a more visible intersection between social work and therapy in social work with people with mental illness than is the case, for example, with other target groups. Each respondent deals with this differently. Some openly admit that they allow themselves to treat clients therapeutically, while other respondents hold strictly to the social agenda, which allows them to refrain from crossing professional boundaries. On the other hand, another respondent actively seeks out courses and education that help illuminate some of the dilemmas in the care of people with mental illness.

Regarding the effect of psychotherapeutic training (or the perceptions of respondents without training) on the construction of the professional identity of the social worker, the data revealed some interesting aspects. A simple typology of social workers could emerge from the analysis of the data obtained from the survey (see Tab. 2). The formal position was the same for all social workers. According to Act No. 108/2006 Coll. on Social Services, all respondents were social workers working in the care field with people with mental illness. In terms of the selection of respondents, we distinguished between social workers with and without training. Moreover, the last column of the table indicates where individual social workers rank on the professional identity scale.

Tab. 2: Types of identities

WHO	FORMAL POSITION	PROFESSIONAL IDENTITY
Mental health social worker without PST training	Social worker	Social worker
Mental health social worker without PST training	Social worker	A/ SW with therapeutic orientation OR B/ SW considering PST training (for various reasons)
Mental health social worker with PST training	Social worker	A/ Therapist OR B/ Social worker - therapist

Source: Authors

Respondents without training referred to themselves as social workers, although they used selected psychotherapeutic procedures in isolation. In discussing their professional identity, they strictly categorized themselves as social workers. It helped them to gain a clear conceptual agenda (e.g. targeting the restoration of the client's social functioning), determine service settings, and understand the law. They rejected therapeutic practice because they felt it was not directly compatible with the social work agenda, as it would mix two separate disciplines. The client might need clarification, making it harder to maintain the established professional boundaries with the social worker.

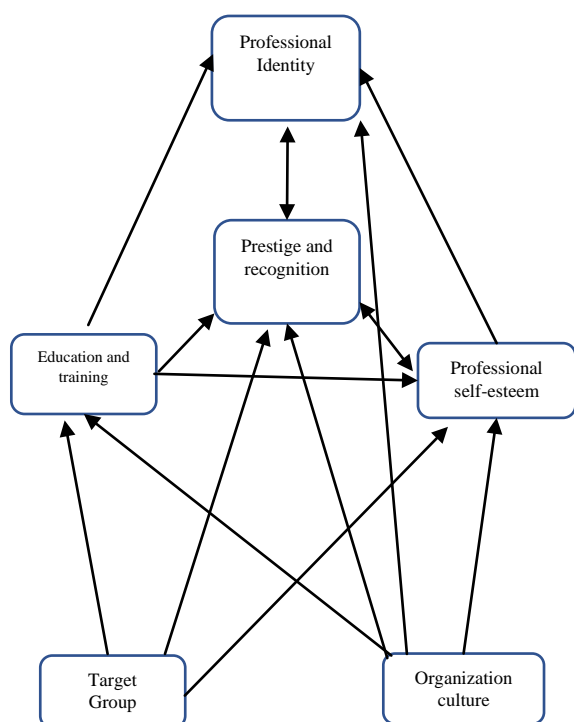
We identified two other smaller subcategories within the category of respondents without psychotherapeutic training. A social worker who, although not trained, was quite open about the fact that their social work was and had to be therapeutic, as the nature of working with the target group of people with mental illness required it. He communicated this consciously and did not conceal his therapeutic orientation. He sought to acquire skills in this area, at least through mandatory training. Furthermore, he found nothing negative about the therapeutic orientation, as he consciously worked in this setting and had permission within the team to work in a more therapeutic style. Another named phenomenon could be a social worker with no training who openly admitted to thinking hard about PST training and probably wanting to take it. The reasons described were mainly the specific nature of social work with people with mental illness, where knowledge of psychology and psychotherapy is an undeniable advantage, leading to better financial reward, career progress, and higher professional self-esteem.

Two streams have emerged in the field of social workers who have completed accredited PST training and are still working as social workers in the system of care for people with mental illness. The first was that the social worker was already categorized as a therapist on the scale of their own professional identity and was taking action then (functioning as a part-time therapist in another organization, changing their contract of employment in the organization where they were working and moving into a therapist role, etc.). These respondents stated why they had decided to undergo training, drawing attention to social workers' poor salaries and social conditions. These respondents expressed regret because they had been in social work for a long time and found working with people with mental illness fulfilling. However, external adverse conditions and a desire to move elsewhere in the professional world forced them to change. The second group was of social workers who had already completed PST training but still proudly referred to themselves as social workers or social workers/therapists. Their statements were dominated by pride in social work, perhaps because they had studied social work, had their first experience in social services, and the social worker position was their first job ever, etc. In general, social workers with no training talked about their identity and the intersection of social work and psychotherapy as is predicted by the independent model, while social workers who had completed PST training tended to hold the views of the selective model (Wakefield, 1988a, b).

6 Conclusion

The text aimed to answer the main research question: *How do mental health social workers construct and reinterpret their professional identity by integrating psychotherapeutic practices into their practice?* The professional identity of social workers is constructed and reconstructed through several factors, including psychotherapy training, social prestige and financial evaluation, personal adjustment and professional self-esteem, organizational culture, and the target group (Figure 1).

Figure 1: Factors in the construction and reconstruction of professional identity



Source: Authors

Based on the interviews conducted, a causal model can be constructed to explain the different conceptions of social workers' identities. This model is based on several factors that may influence how social workers understand and construct their professional identity.

Factor 1 – Education and training: Social workers who have received psychotherapy training may redefine their identity in favour of psychotherapy and begin to see themselves as therapists. This training can give them new skills and perspectives that can influence their professional identity.

Factor 2 – Social prestige and financial reward are other factors that can motivate social workers to redefine their professional identity. Psychotherapy may be perceived as a field with more prestige and better financial rewards, which may be appealing to social workers seeking professional growth.

Factor 3 – Personality settings and professional self-concept: Social workers with strong professional self-concepts and certain personality traits may be more inclined to redefine their professional identity. They may feel more competent and confident in their ability to understand and help clients if they integrate psychotherapeutic practices into their practice.

Factor 4 – Organizational culture: The organizations where social workers work can also influence how they construct their professional identity. If an organization welcomes the integration of psychotherapeutic practices into social work, it may motivate workers to embrace a new role and redefine their professional identity.

Factor 5 – Target group: e.g. in working with people with mental illness, it is possible to see the intersection of social work and therapy more than with other target groups. This may influence how social workers perceive their role and professional identity.

However, this model is simplistic and may only include some factors that may influence the professional identity of social workers. The reality is often much more complex, and each social worker may have a unique combination of factors that shape his or her professional identity. This study also showed that changes in professional identity can manifest in various forms, such as greater self-awareness, congruence, and authenticity when working with clients, or a more open approach to therapeutic methods. The significance of this finding is that it allows us to gain a deeper understanding of the variability and dynamics of social workers' professional identity. This has important implications for social work practice as it provides insight into the potential benefits and pitfalls of integrating psychotherapeutic methods and skills into everyday client work. In addition, these findings contribute to a better understanding of social work training and supervision needs, which may lead to a more effective and responsive approach when working with people with mental illness.

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Primary Paper Section: A**Secondary Paper Section: AN, JJ**

DEFICIENCY AND RECALIBRATION OF HUMAN RESOURCE MANAGEMENT PRIORITIES IN AN ECONOMIC CONTEXT (LOOKING AT PROBLEMS FROM ACADEMIA)

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Abstract: Human resource management theory, commonly known as Human Resource Management (HRM), is currently looking for different concepts to find ways to stabilise employment relationships in the current "turbulent" economic environment, which is also marked by the aftermath of the Covid-19 pandemic. One possible way at the corporate level is the importance of the human factor, i.e. in particular the qualification and flexibility of workers as an effective corporate response to crisis phenomena in the economy or society. This view of the important role of employees in the economic prosperity of the business is not, of course, current news. It can therefore be defined that the main factors of the economic prosperity of the company are not physical, i.e. invested natural resources and capital, but the human factor. Building on this premise, the area of human resources management can be derived from the practice of capital investment, which has always followed the future of the business and is based on the situation it was in and where it wanted to go. In a sense, part of running a business should be the process of partially relocating company funds to staff training and qualifications. The employee development and care factor are increasingly seen by economists as a tool for the company's profitability and growth. In the economic context, in international relations, the issue of education and development is addressed, among other things, in the framework of economic diplomacy. Economic diplomacy is, in the simplest definition, the economic dimension of foreign policy, when this foreign policy, as part of diplomacy, means many uses of economic relations not only for the development of companies. It can be defined as facilitating access to foreign markets for domestic firms, attracting foreign direct investment to the nation state, and influencing international rules serving the national interest, in a wide variety of ways, including education. In modern economic diplomacy, which is now quite broadly defined, the tools can be used in a wide variety of ways. The work of trade diplomats can then be better viewed in various processes, for example in advice, representation, but also in trade and investment promotion and foreign direct investment. Such economic diplomacy already has a managerial dimension and a trade diplomat can, with the right management, focus on promoting international trade. The economic diplomat is then not overwhelmed by technical fields, science, research, tourism and can easily increase the efficiency of his work.

Keywords: corporate environment; economic diplomacy; Employment Branding; human resources management; staff qualifications and flexibility; staff training.

1 Introduction

In both theory and practice, there is at first glance a dichotomy problem, which is referred to as the hard and soft version of human resource management. The hard version of HRM considers employees as an equal factor in the production and delivery of services in the same way as land, labour, capital, and technology. The workforce is planned and adopted rationally, deployed as needed, and mechanisms are set up to "get rid of people quickly" if necessary. Businesses place emphasis on shaping the organisational structure, control costs while keeping staff numbers as low as possible, and their marketing strategies adapt to market demand. Managers have unilateral decision-making powers vis-à-vis employees, the value of people derives from their ability to perform according to the requirements of the business. All personnel work is aimed primarily at increasing the company's competitiveness. The focus is on the rigorous monitoring of staff performance, strict discipline, in other words the interests of the organisation to some extent outweigh the interests of workers. While this concept of human resources management may be effective in some areas, it can cause negative phenomena in the long term in the form of staff dissatisfaction and ultimately lead to staff turnover. This version of HRM can also put businesses in dispute with trade unions and, in many cases, is not "compatible" with ongoing state interventions and labour market controls. The fact remains that almost every work process or service provision cannot be designed and implemented to eliminate the need for initiative and cooperation from employees. In this context, it can be recalled that, in the economic reality of developed countries, there are still, to put it mildly, two models that are "trying" to solve the labour problem. The first approach is professionally called "Nike," whereby a group of entrepreneurs and marketers develop a particular market plan and design for the products or services they introduce to the market. They order the production of these products from outside firms and then trade either on their own or with the help of specialised traders. The second approach is called "Microsoft" where, apart from management, the company only holds a very narrow pool of professionals with

the relevant know-how. The selection of these employees is strictly exacting according to the measurable suitability criteria of the candidates for the development and innovation of the intended products. Other activities such as manufacturing, marketing, logistics and trade are internalised. These entrepreneurial approaches are often driven by efforts not only to minimise costs, but also to avoid solving staffing problems in the employer-employee relationship.

The soft version of HRM is mostly prevalent in business organizations and service-oriented businesses. Human resources managers support the development and motivation of workers. Companies are building their competitive advantage precisely in a high-quality workforce that is responsive to customers and tries to address their needs. For the most part, these organizations have maintained certain rules, values, and ethical standards in their activities. Management and worker relationships are more based on trust and partnership. This approach is understood by business and individual workplaces as a coherent, harmonious entity. Businesses value quality work performance but at the same time try to help address workers as well as their personal and social needs. The central line of this system is the delegation of authority and responsibility to the lower parts of the proceedings, except for specific individuals. Employees are expected to be more involved in achieving the organization's goals, and more willing to perform work tasks often beyond normal duties. It should be remembered that a soft style of managing people has its costs and its challenges. It represents, among other things, the need for permanent training and learning in workplaces, deepening in-house communication through deliberations and meetings, promoting teamwork, and finding ways to maintain sustainable interpersonal relationships in the business. In particular, the risk of a soft approach is that higher staff costs can threaten a company's competitiveness.

In terms of a company's competitiveness, international global relations are also important, because in the national market the competition from firms is not nearly as strong. Slovenian economic diplomat Gorazd Justinek (in Van Bergeijk, Peter. A. G., 2019, p. 30) points out that the evolution of economic diplomacy at a time of economic globalisation, which is in many ways complicated by external factors and brings more often negative consequences to society, is uneven. The current evolution of economic diplomacy is being shaped and co-created by many new stakeholders in the age of globalisation. These new parties are both new media and new technologies including the financial and commercial parts of the process.

If we were to consider the measurability of competing, it is precisely any competitive rankings that can offer a wide range of assessments, both entire national economies, as well as of individual firms and the business environment. The most famous are rankings from the institutions of the Institute for Management Development IMD or the World Economic Forum. These institutions use both soft and hard data, as a mix of institutions, policies and factors that determine a country's productivity and can make comprehensive assessments. Even closer to the business environment and corporate culture, the Ease of Doing Business Index was created by the World Bank, which significantly influenced corporate and investor decisions until 2022.

2 Defining the concept of personnel management

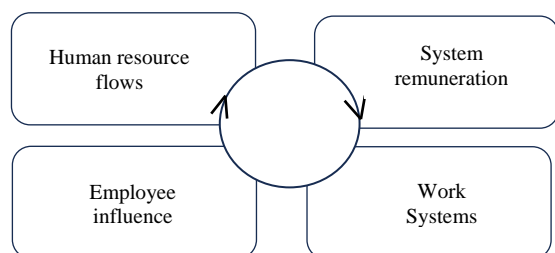
In human resources management theory, the question of the content of corporate personnel activities and their arrangement is discussed. With a certain amount of simplification, it can be said that there is a so-called Universal Conception personnel management and a concept sometimes called Best Practises. The universalist concept bets on the selection and combination of proven approaches and actions to ensure high worker performance. Hermann (2007) conducted so-called meta-

research, comparing the results of 55 researchers on various "proven" techniques of personnel work in both US and European enterprises between the years 2000 and 2005. More than two-thirds of this research confirmed a positive correlation between the training provided to employees on the one hand and the increase in labour productivity on the other. Ninety per cent of research has provided clear evidence that high-quality and functioning remuneration schemes lead to a reduction in unwanted staff turnover. Interestingly, the different forms of teamwork in the business more than half of these researchers have an ambivalent relationship to the higher performance of employees. Research has also shown that in several cases, management, support, cohesion of work collectives is leading to the achievement of projected objectives, i.e., people "coming together" and working more effectively. On the contrary, some research has shown that the firm's push for more cooperation between teams has led to conflicting results, in particular the strengthening of negative target attitudes and relationships between collaborators. Generally, it is difficult to identify applicable personnel labour practices within this concept in all the situations in which an enterprise finds itself. Examples of proven universalist, i.e. generally applicable activities are provided by Boselie (2005). This involves targeted staff selection, regular performance evaluation, or conceptual qualification training. The universalist concept presents a somewhat open question of HR management theory.

An interesting link between personnel management and economic theory is within the theory of efficient pay. The concept has long been well explored by various authors, such as Solow, Zellen, and Katz. Katz (Katz 1986, p. 235-290) stipulates that it is useful for businesses in a market environment to set and pay a wage that is higher than the one balanced on the labour market. He calls such a wage efficient and expects an increase in employee productivity with it. The company hires a worker in such a way that it is unable to verify the productivity and quality of the employee in advance, also fluctuating workers is costly. The premise of the theory is that the worker makes his or her own decisions about the effort, and the sense of proper treatment and pay has an impact on both performance and effort. In view of the presence of involuntary unemployment, the economic situation is such that workers are willing to work at a lower wage, but companies do not want to hire them, as this would reduce wages for existing employees and could lead to a drop in productivity and consequently increase the costs of the company. But such a situation is inappropriate. Katz (1986) assumes that efficient wages stimulate long-term contracts. Overall, wage efficiencies, higher than equilibrium wages, are a gain for both workers and employers, who also benefit from long-term wage contracts.

The concept of Best Practises, representing a volume of four main practices of personnel management, is by the authors Schuler, Galanta and Jackson (1987). It should be noted that this is one variation of the composition of a functional entity in human resources management, taking the form of a Lauergram, i.e. a regularly distributed set of elements that are of "equivalent" importance to the functioning of the whole system.

Fig. No. 1 Lauergram in human resources management (adapted)



Source: Schuler, Galanta, Jackson (1987)

According to the authors Schuler, Galanta and Jackson (1987, p. 62) the human resources management system is thus articulated, and "traffic-spinning" geared towards an effective relationship of personnel costs and professional competencies, people's performance, and commitment to enterprise. Human resource flows form the first (but also the last) part of the cycle and involve selecting and recruiting staff, deploying them, promoting them, evaluating them, educating them, including terminating employment relationships. Pay schemes then include salaries and wages, employee benefits and bonuses in order to recruit, motivate and stabilise valuable workers. The system of work, according to these authors, is made up of separate units of standards and various processes in companies, which are aimed at creating and defining work tasks, using people's creative work following the application of information communication technologies. The area called "Employee Influence" is a particular feature of the concept. The authors believe that the company (as a certain peak of human resources management) needs to be built alongside formal management and decision-making structures as well as another "voluntarily delegated level of competence, responsibility, power and the possibility of employee involvement in decision-making". In this context, it is emphasised that this part of people's leadership is indispensable in crisis situations, when it is frequently disrupted, the official organisational structure collapses, and there are various disputes over powers and responsibilities between separate parts of an enterprise or individual managers. One can agree with this view that the recent coronavirus pandemic has shown a number of up to "primer examples" of chaotic crisis management, not only at the level of businesses but also at the level of state authorities.

Human resources management represents, in theory and practice, a whole complex of different corporate, organizational activities from selection and hiring, through their adaptation, training, pay development, and work performance promotion. It is reasonable to assume that this system (like other social systems) contains various deficiencies, i.e. deficiencies or outstanding problems. One of the objectives of this study was to identify these deficiencies for further, detailed scientific research investigations. A research investigation conducted under the name "People management" by the Central European Higher Education Alliance (www.ceua.cz) in 2020-2021 also had this exact sub-goal. The authors of this study were part of a research team. The investigation took place in the form of focus group in two rounds and was aimed at identifying and assessing human resource management issues in the transition of economies in selected central and eastern European countries. Focus group participants included 18 academic staff from a total of 13 universities from a total of 8 countries, excluding the Czech Republic, and these were schools from Slovakia, Poland, Hungary, Ukraine, Slovenia, and Croatia. They were teachers and scientists from the education sectors of the corporate economy and personnel management. In an online discussion, experts have formulated their views on the changes underway in human resource management in the corporate sector in both industry and services, largely in market-oriented organisations. In other words, the facts established tell us about reality through the views of academic staff. This starting point must be taken into account when interpreting the significance of the issue..

3 Specifics of the human resource management challenges

Respondents to the above research investigation in their contributions paid particular attention to certain situations in HR management, which need to be more reflective in theory. From their point of view, these particular points can be made.

The problem of indecent remuneration of managers

The problem is widely known, and there are a number of hard data to prove its topicality. Participants in the discussion are quoted by Jean Pisane Ferry (Project Syndicate, 2014), a French economist, who has for several decades highlighted inequalities in managers remuneration in state-owned companies. At Peugeot, for example, 10 senior executives have a salary of around 5.5mil. Eur a year, a worker of the same company would have had to

work for that sum for over 240 years. The problem is global, with calls in many countries for regulation of managers remuneration, especially within state and semi-state enterprises, where managers can often agree and award hefty bonuses. The problem is with us, too. Many state-subsidized enterprises, for example, have people with more than half a million monthly salaries in charge of Czech Railways. The problems of disproportionate and extremely high rewards also affect athletes, artists, etc.

The Problem of Corporate Boss Psychopathy

Colleagues at Focus group point out that there is a range of relevant and representative research confirming that around 20 % of chief executives of different firms show signs of psychopathy. Typical traits of a psychopathic personality are inability to empathize with employees, superficiality in judging things, seemingly quick decision-making, arrogant and overly sovereign actions, and behaviour. The opinion of Australian psychologist Nathan Brooks (2021) from Bond University is quoted as saying that the percentage of psychopathic business leaders is only slightly smaller than among incarcerated people. It is clear that these psychopathic traits often appear as the impact of performance pressures and the subsequent burn-out of managers.

The Problem of the Poor Workers

Accompanying features of today's society include the fact that there are people living and working in each country whose income is only just above the limit of a viable life. We are not talking about pensioners, but about people who work in a variety of low-skilled professions, but their remuneration is enough to rent housing with services, food and other strictly necessary expenses (in the Czech Republic, this amounts to a gross monthly wage of 16-18 thousand crowns). (CSL, Household Consumption Expenses, 2022) These people have problems with, for example, buying clothes, attending cultural performances, holidays etc. In their lives, they are literally balanced existentially between a "normal life," living in a grey economy and living on welfare in a social exclusion. Our terms and conditions account for 13 % of all employees, according to the statistics. (CSL, Household Consumption Expenses, 2022) It is interesting that the practice of these salaries is introduced in particular by some foreign companies, such as Amazon, as some of the debaters have said.

The problem of little social recognition of manual, physical work

Again, this is a Europe-wide and partly a global problem. Most parents in our country and in other developed countries strive to ensure that their children have, as high as possible, a university education. In other words, white, not blue, collar status is vastly higher in society. Craftsmanship is considered inferior, socially intolerable. In practice, this situation is reflected in the very low interest of both young people and their parents in the craft professions. This is also happening in circumstances where a shortage of such workers leads to higher earnings for existing ones. The mantra of "sophistication" and distaste for physical labour is leading advanced countries to import this labour from abroad.

We consider warning of these problem situations to be the subjective opinions of the respondents to the research. However, the discussion also highlighted that these topics form a taboo of both theory and practice. The next stage of the research investigation discussed the current problems of HR management in the current situation of the economy and in terms of the functioning of the labour market in individual countries. Focus Group participants across schools and countries agreed on the need to recalibrate (reconfigure) HR management priorities, both in businesses, institutions, and other organizations. The following opinions and arguments can be mentioned from the topics.

3.1 Enterprise human resources management priorities

In particular, businesses should prefer these measures in human resources management.

Strengthen employment branding of companies

Stein (2013, p. 86) is understood by Employer Branding to mean "Creating a clear employer profile in order to present itself as an attractive employer in the labour market". The author sees an analogy with building an unmistakable brand for business products with the life of an employer's brand designed for the target groups of desired employers. An undertaking in competition must secure a competitive advantage in the labour market. This is largely in the view of our colleagues involved in the inquiry into the imperatives of HR management at the present time. In a number of cases, these are concrete actions undertaken by the company in the area of worker education and care, in the form of various bonuses and benefits for prospective employees. Nonetheless, it is a wider issue. Bergdolt (2014, p. 154) understands "building a business brand as a complex process involving, on the one hand, personnel planning and finding the strengths of the business and, on the other hand, objective criteria for assessing work performance and respecting the needs and requirements of all professional groups of employees". The Focus group took the view that businesses should in particular strengthen the so-called Employer Value Proposition (EVP) or the employee's so-called value proposition, which involves creating plausible indisputable acts that affect both the company's inner life and its public presentation. Colleagues are of the opinion that the firmness, viability, and acceptability of the company brand is shown especially in various crisis situations. Many businesses will not be able to avoid job cuts, changes in the remuneration system and other negative steps in their development, where the trust of employees or those around them to lead and damage the organisation's so-called goodwill may suffer.

Enrich approaches to staff selection and deployment

Stein (2013, p. 100) sets out "classic" criteria for assessing the capacities of prospective employees in their selection. This is mainly the expertise given by completed institutional education and other, especially professionally oriented education. Other criteria are the candidate's physical and psychological state, psychomotor skills and other requirements that arise from the specifics of the production or services of the organisation. Thomson (2007, p. 109) discusses the process of selecting and deploying workers, the nature of which is inherent in the characteristics of work activities. The author builds on the "ensemble" created by Hackman and Oldham (1976), which forms diversity, identity, prominence of work tasks, autonomy, and feedback of an employee's work performance. In this context, it sets out ideas for how to develop these characteristics of work activities and ultimately increase productivity at work. These personnel management tools include "...work rotation, increasing the authority, responsibility and therefore identity and importance of workers, the creation of autonomous working groups and quality rings in the company". Discussing participants in Focus group largely agreed on the knowledge that the classic scheme for selecting and deploying workers known as Selection Criteria - Characterization of jobs and occupations - Hiring a particular worker in a given position is now no longer sufficient for the problems of the current labour market. Today, it is very difficult for a particular individual to meet all the selection criteria while at the same time meeting the requirements within the characteristics and associated entitlements to perform specific work activities. The problem is that while a worker does not meet some of the criteria and requirements, their qualities are elsewhere and therefore cannot be used within the job. Or a situation arises where the worker overfills some of the criteria and requirements and the result is the same. In this context, colleagues in academia write about the need to introduce the so-called Tailored Position (TP), or jobs literally "tailored" to some of the selected applicants for a job at the company. In essence, it is about creating jobs that are

compatible with the skills and experience of those interested in working in the business. In other words, in a particular company, a system of well-defined criteria per employee and categorical duties can be supplemented by a loosely defined system of jobs and roles tied to the professional and personality competencies of the people selected

Diversify business education more widely

Discussions around the education system in a business environment are quite rich. On a professional level, and this has been confirmed by the research carried out, business education can be understood as part of the management, economic and social cultural processes in the business. Oleksyn (1997, p. 9), which characterizes the essence of company training as *"increasing (updating) theoretical and practical knowledge, as well as developing the psychophysical characteristics and common behaviour of employees needed or useful in professional work, in such a way as to prepare for the good fulfilment of job roles in the future, as well as expanding the content of the work and the adoption of new organisational roles and the development of an organisational culture"*. Tight (2002, p. 33) states in this context that the main problem of business education is called Vocational or Liberal (vocational and liberal, respectively broadly focused). The authors of this article are aware that the terms liberal and vocational education are, of course, emotional, and ideological. Rather, the nature of the problem lies in the individual level, i.e. whether a particular worker needs more career-specific training or general (humanitarian) focused training to support their working capacity. According to the authors, such a differentiated approach to employees is essential and understandable. Employees may have different individual profiles. It is now common place in the labour market for some jobs to be held by people whose previous education and experience may be different from the field in which they now work. For this reason, it is necessary to give them priority for vocational training. On the other side, there are people in companies with the appropriate professional basis, whose level in so-called professionally independent, transferable skills (for example, working with ICT devices) needs to be strengthened with the help of their participation in specialized courses. A majority of focus group colleagues were in favour of a broader breakdown of business education and training activities, which would not only apply to specific professions, jobs, and roles. Businesses should think more about finding their place in business education, for example, with courses that increase employees' financial and health literacy. At the same time, it should be noted that alongside this opinion, eight colleagues expressed some scepticism about the potential effectiveness of business education in relation to the development programmes of organisations. In this view, there are large financial costs involved in company training, which do not always translate into increased staff performance. Furthermore, colleagues highlighted the problem of protecting these investments, as an employee can put newly acquired knowledge or knowledge of working practices into service when changing jobs with another employer.

Business education has a clear link to the socioeconomic environment. If a company is willing to train its employees, it is always because it is sure that investment in employees and thus in its own company will not be lost, the state's institutional background will be preserved and probably improved. The state has the legitimacy to positively influence corporate investment in this regard, both by increasing the credibility of institutions and by state intervention in economic diplomacy in an international context. Export promotion agencies are a positive support to companies for further training in export activities. Martin Dvorak (Markova, Havlova 2020, p. 9) stresses the importance of the workers of state agencies, namely CzechTrade, CzechInvest, Czech Tourism and the Czech Centres, where state employees are prepared to support private companies, which can also benefit from some support services of these agencies free of charge

It is evident that these three topics, which in the opinion of most academic colleagues, participants in the research inquiry believe could be at the forefront of business management priorities, are in themselves only partial issues. Still, strengthening the organization's brand as a reliable employer, having some flexibility in determining the workload of employees, or seeking effective training activities to support employee performance are "constants" in the personnel management system. In general terms, however, it is the area of human resources in a business that is very often subject to different changes, otherwise people are treated by a business in a stage of growth and development, otherwise in a crisis etc. We see differences in approach to the human agent in a large company compared to a medium or small company. In general, personnel activities should form a particular system within a given company or organisation, with sub-elements in the form of the selection of workers, management of their adaptation, choice of method of remuneration, education, development etc. The human resources system should be flexible, responsive to the situation in and around the company, which is particularly relevant to the choice of enterprise personnel policy priorities.

4 Focus Group outputs

In the context of the focus group discussion, it is possible to mention two minority views that were discussed. One of them is on a theoretical level, and it was two colleagues who came up with it. This is the role of the human resources management system in shaping the company's so-called capacity. The concept of capabilities is referred to as *"skills and mechanisms required for the integration of tangible and intangible resources for the benefit of the firm as well as as a means of transferring and using knowledge in the firm."* Authors Pisano, Teece and Shuen (1997, p. (32)) characterize the concept of dynamic capability (dynamic capabilities) as *"the ability of a firm to integrate, build and reconfigure internal and external competencies with an emphasis on a rapidly changing environment"*. Other authors Morris, Snell and Wright (2005) distinguish creative and integrative in the context of the analysis of international human resources of capabilities. The creative capability of companies, according to these authors, is an international experience in business, company relationships in the social environment and the behaviour of the company in the market. Integrative capability is the firm's *"absorption capacity"*, i.e. whether the firm is capable of innovating in technology and technology and translating their manifestations into corporate culture and internal social and cultural relationships. The built and available resources of businesses are important in this context. Overall, resources in the corporate environment can be divided into tangible ones, which are machines, technology, finance, etc. Furthermore, the resources of the enterprise are of an intangible nature, such as corporate culture, reputation of the business, patents, industrial designs, managerial skills, etc. The colleagues in question understand the process of creating capability as a measure of control and integration of material and intangible resources, i.e. some connectivity of technology, technology and the human factor in the business. A problem suitable for further research investigation, however, is the measurement of the rate of capability achieved, noting that it can be difficult to set any standards, to identify indicators that influence the *"positive"* state of the business. In other words, HR management as a science, should move from a theoretical and hypothetical grounds to specific exact conclusions. In their research, the aforementioned colleagues worked, for example, with parameters for the degree of manufacturing equipment with technology combined with the development of skills, knowledge, and skills of the workforce. These examinations show that the firm's improving technical equipment should be correlated with higher investment in staff training. This increase in the cost of physical and, by extension, human capital should lead to a change in certain economic indicators, in particular turnover, the percentage of profit from funds contributed or net absolute profit (after tax) per employee. The view of the company's capability can be supplemented by analyses of the number of employees and their breakdown into production (services), administrative part, management structure, sales etc. The fact is that every business, especially in a market

environment, deals with the added value of its employees, examines the level of wage costs to labour productivity and is still moving towards the profitability of both technical and human resources work. Capability is largely a theoretical construct that shows a broad spectrum of all factors influencing human work, i.e. management and development of employees.

The second minority view was provided by three colleagues and represents an unusual and rather practical view of the role of human resources management. Businesses, organisations, and institutions have developed a range of ways, techniques, methods and forms of work within business education such as seminars, conferences, discussion forums, roundtables, panel discussions etc. These intangible products can be used as relatively effective instruments of economic diplomacy. British economic diplomats Nicholas Bayne and Stephen Woolcock (2011, p. 108) define economic diplomacy with the help of three elements, facilitating access to foreign markets for domestic firms including education, attracting foreign direct investment to the nation state, and influencing international rules serving the national interest, in a wide variety of ways. On a general level, economic diplomacy can be seen as the activities of individual countries in the context of "attracting" foreign investors to the national economy. The states, and here we are talking about the countries of Central and Eastern Europe in particular, are becoming active actors in this sphere. The essence of economic diplomacy is understood in the context of marketing communication, presentation, and educational activities. However, from the perspective of colleagues, the state as a subject of economic diplomacy is not a homogeneous entity. This activity is carried out by consultancy centres, investment organisations, businesses, their associations, or non-profit organisations. Respondents pointed to the fact that individual actions under economic diplomacy, but also the overall quality of the human resources management system, are the "flagship" of countries' economic policies. Human resource management systems in enterprises represent "public value" and the first line of economic diplomacy mechanisms. In this space, according to respondents, there is a great potential for improving economic processes at national, European and global level.

Swiss diplomat Olivier Naray (in Van Bergeijk, Peter. A. G., 2019, p. 126) stresses that, in the current modern economic diplomacy, tools can be used to better organise the time and role of commercial diplomats within the processes of advising, representing, but also promoting trade and investment. Such economic diplomacy already has a managerial dimension, and a trade diplomat, based on good management, can devote what is important to him to his core business, which is to promote trade. It is not overwhelmed by technical areas, science, research, tourism and can easily increase the efficiency of its work, thanks to efficient management.

The state has a variety of tools in this sphere to support entrepreneurs. These are not only activities to promote training in companies, but also activities to promote the value of exports, which are a common goal for increasing the competitiveness of the state. In economic diplomacy, many instruments that are useful for economic development can be applied. Instruments of economic diplomacy are an important component of operating within diplomacy. These instruments are a link between classic economic policy tools and those used in diplomacy. In recent years, it has become increasingly apparent that there is a shift away from positive instruments to boost economic growth within liberal relations to negative ones. Negative instruments are used within protectionism to achieve the aim of protecting the domestic market. The simplest tool is such a duty, but it can also be different sanctions or boycotts. Negative economic diplomacy, in turn, greatly aids in addressing critical influences from the outside.

5 Conclusion

This article focuses on the issue of the systemic management of human resources in the corporate environment at national and international level. Focus Group's investigation was aimed on

the inner operations and quality of personnel activities. In the discussion forum, the trend was confirmed that in personnel management in the current business environment of European countries, it is not just about ensuring a person's basic needs, but also particularly about acknowledging the performance of the worker and his contribution to the success of the organization. An increasingly important role is played by the personality of the worker, or by his or her personality preconditions for the performance of his or her profession and job position. Workers increasingly understand work as part of self-fulfilment, often more important to them than pay, a good atmosphere at work and the sustainability of people-to-people relationships. Fellow academics also highlighted the importance of the working environment, i.e. the location of the work place, in particular how much space the individual will have available, lighting, air conditioning, social facilities, dining room, showers etc. Companies often reach out to employees and try to make spaces where employees spend a lot of time improving and, as they say, "personalizing". Australian economist Clark (2007, p. 22) said as follows: "While capital investment is undoubtedly necessary for economic growth, it is not yet a controlling and decisive factor. It may be said that the main factors for economic growth are not physical or natural resources and capital invested, but human." American economist Galbraith (2007, p. 92) is of the opinion that "Investing in people is as important as investing in tangible capital. Today, a better use of capital (i.e., technical progress) is almost entirely dependent on investment in education, teaching, and the possibility of applying scientific knowledge". In the corporate environment, the possibilities of compensating activities towards employee relaxation are expanding. There are various relaxation nooks in corporate headquarters where you can just sit and listen to music or even practice yoga or other relaxing activities. The aim is to encourage people's willingness to work, to influence their loyalty and, naturally, their productivity at work. The Covid 19 pandemic partially changed this situation, with some employees bringing their work activities to their homes. Companies have tried to provide not only the necessary computer equipment for these employees, but also to make this home work environment more comfortable for employees.

In the discussion, it was confirmed that the importance of specialised professionalised personnel management departments is growing in the corporate environment. In this organisational component of the enterprise, activities of working with a human agent are concentrated, new concepts of supporting workers' performance are being "born". In this context, it must be underlined that an important condition for the quality and efficiency of personnel activities is the ability of human resources specialists to team up with line managers as well as other agents, professional units of the business. As one research investigator pointed out, "HR management specialists will have to coach, flatter, and persuade their colleagues, line managers". This process must be the standard of their work and accelerate particularly in situations where a business makes certain changes in production or services, whether forced or planned. We absolutely have to agree with Anderson and Evenden (1998), who say: "HR management systems can be designed by specialists in HR, but their success depends on how they are implemented by line managers. It is the managers who are tasked with planning the future with the help of a critical view of the past. They must conduct assessment interviews, agree targets and performance gaps before identifying development needs. There are performance and progress monitors of the individual, their coaches and advisors who support, guide, and motivate. The strategic management of human resources stands and falls with its own performance of the managerial role of the people". The debaters said that strategic approach in the field of human resources management is now a generally accepted trend. For the most part, the strategic management process takes a linear form where the target status of the business is set and appropriate long-term, medium-term, and operational decisions are taken to achieve it. These decisions are different in nature, but the "core" is innovation in technical and technological processes, which are linked to the skills development of the workforce. Human resources management as a whole is increasingly tied to building

a competitive advantage for employers, which has economic-social aspects. On the one hand it is about performance, productivity at work and on the other hand it is about employee satisfaction with work in a business, organisation, or institution. Finally, one participant in the inquiry can agree that "in human resources lies the generator of solutions to all possible situations and thus the potential for success (or difficulties) of the business, organisation or institution".

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INTERNATIONAL COMPARISON OF EXPERTISE AND THE STATUS OF THE EXPERT IN SELECTED EU COUNTRIES

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Abstract: The aim of this work is the evaluation, analysis and comparison of expertise and the position of an expert in selected countries of the European Union, specifically the legal requirements for the performance of expert activity in selected countries of the European Union, primary differences in the content and formal structure of expert opinions in selected countries of the European Union. For the collection and analysis of data to fulfill the goal of the work, a content analysis of the laws and standards associated with expert activity was used. Subsequently, the method of comparison and comparison of the legislation of individual selected countries of the European Union was used. The article contains a basic comparison of the national legislation of selected member states of the European Union in the field of expertise. It thus brings scope for the possible use of the information obtained for the eventual modification of legislation as well as for further research in this area focused on other related issues in the field of expertise.

Keywords: legislation, expert law, expert assessment, education of expert

1 Introduction

Expertise is becoming an increasingly important element of criminal proceedings. Confidence in such evidence is crucial to the integrity of the judicial process. However, little attention has been paid to the errors of experts who have testified in criminal cases. Although rare, their serious impact on justice and public confidence requires analysis in this area (Freer, 2020). Courts have established the principle that expert evidence must be based on "a sufficiently reliable scientific method to be admitted" through a series of legal decisions and practice guidelines. However, there is still not enough case law to determine what degree of reliability is "sufficient" (Ward, 2020). When we consider the necessary expertise and precision in the process of forensic evidence, the clarity and meaning of the questions will help us get optimal answers (Asin Sanchez, 2020). Forensic examinations and organizations generally lack experts. This is also due to the fact that there are not enough fields of study to enable students to become professionals with the appropriate knowledge, skills and responsibilities required in this field (Krulicky, 2022).

The current European legislation does not regulate the field of expertise in a comprehensive way and pays more attention to areas where the regulation is much simpler. These areas include, for example, the area of European private international law, which includes the unification of conflict of laws rules, procedural rules and the regulation of the recognition and enforcement of judgments given in one Member State in another Member State (Chirieac, 2020). There are then considerable differences in the status of experts and expert witnesses between the Member States of the European Union.

Ensuring the proper performance of expert activities is very important, as it is of crucial importance especially in disputes that usually require the preparation of an expert report. For example, in the Czech Republic, the activity of an expert is regulated by the Act on Experts, Expert Offices and Expert Institutes (Act No. 254/2019 Coll., as amended), which sets out the procedure for processing applications for registration in the list of institutions qualified for expert activities. However, not all EU countries have the same conditions for the performance of expert activities or requirements for their qualification.

The aim of this article will be to evaluate, analyze and compare the expertise and the status of the expert in selected countries of the European Union.

The following research questions will help to achieve the objective:

Question 1: What are the legal requirements for the practice of expertise in selected EU countries?

Question 2: What are the primary differences in the content and formal structure of expert reports in selected EU countries?

2 Literary research

The use of experts in legal cases has been of some concern for a long time. From the outset of their involvement, litigants have feared bias, as well as lack of knowledge and inadequate influence on expert witnesses (Rosen, 2020). There are individuals who are experts in a particular field, but at the same time have a different set of opinions and preferences regarding a given issue (Guerrero, 2021). It is therefore essential that attention is paid to issues relating to the competence of forensic experts and the quality of forensic expert databases. Therefore, the study Bjelovuk et al. (2021) examined registers of forensic experts in selected European Union countries through observation and comparison. In essence, the key factor seems to be whether good trustworthiness indicators apply equally to information seeking from experts in online and offline environments. As a consequence, expert credibility criteria may differ significantly for information seeking in online and offline environments (Boyd, 2022). Given the importance of digital evidence to many queries, the services of experts in digital forensics are often sought. In some cases, a "digital forensic expert" may be required to conduct specific investigative work and provide expert opinion (Horsman and Shavers, 2022). Online environments have also explored Kaplan et al. (2020) where they found that laypersons give lower ratings to all sets of items representing investigative techniques compared to social science experts. Article Maslova (2020) also addresses the problem of trust in experts as scientists, and the concept of expert examination is critiqued in an attempt to limit the political authority of experts in order to protect a democratic system based on equality. The critique stresses that the possibility of dissent is important for trust in experts, as it enables the detection of errors and abuses by experts.

Typically, forensic service providers do not learn how to transition from the desk or lab to the courtroom. Strict laws, especially rules of evidence, are vastly different from discussions and reports in the lab (Epstein, 2019). Forensic services were also examined in a study Reid & Howes (2020), where they found, through content analysis of expert reports and corresponding testimony, that expert evidence in courts is significantly more likely to follow recommendations than reports. An experimental study Scobie et al. (2019) examined the impact of differing expert reports on the credibility of unverified forensic evidence. They concluded that differing expert opinions can influence jury decisions, but that the assessment of the reliability of forensic evidence influences the outcome, and biases against forensic science influence the assessment of forensic evidence. In the legal field, there is a view that expert activity, because of its specificity, is much more diverse than legal proceedings, whether they take place in administrative or criminal proceedings (Khrystov and Lipynskyi, 2019). In the study Kliuiev et al. (2021) the authors, on the basis of the current legislation of the European Union, analyzed the specifics of the legal regulation and application of forensic expert research in the course of judicial proceedings. The authors concluded that a fair court decision can only be achieved if the legal provisions related to the dispute in question are taken into account. Research Depauwa (2020) reveals the minimum standards that need to be developed by examining the measures taken from a legal and forensic scientific perspective to use forensic expert evidence. He finds that in examining the feasibility of such standards, primary sources of legislation, policy documents and court decisions at the European level are compared with comparative studies of domestic standards in six jurisdictions. In the study Jones et al. (2023) using a simple contrast multivariate analysis of variance (MANOVA), they found that perceptions

did not differ between in-court, videoconferencing, and telephone testimony conditions.

Study Shaboltas et al. (2020) focused on identifying the main ethical dilemmas of psychologists who are required to prepare expert reports for court. Using a content analysis of court materials and written expert reports, they found that the specific roles and tasks of a forensic psychologist differ from those of a psychiatrist, counseling psychologist, or psychotherapist. Ethical issues are often resolved by professionals based on their own attitudes, which may pose a risk of violating professional ethics. The Court of Justice of the European Union has ruled that expert opinion can only be accepted if it is based on the standards of the international scientific community but has not stated what those standards are (Areh, Verkamp and Allan, 2022). In the context of the project Juehling et al. (2023) a statistical analysis was performed on several variables that were obtained from forensic reports and reports of findings. Regression and bivariate analyses were used to test the effect on asylum proceedings and showed no statistically significant results for an objective change in participants' asylum status.

Article Chiknaverova et al. (2019) used classification and descriptive methods in examining the applied research literature. The findings reflect factors that relate to the professional exposure of graduates and the content setting of LLM programs. Bonal-Zazo & Ortego-de-Lorenzo-Caceres (2020) Examined, through content analysis, references to the processes of document creation, capture and management in the General Archives Act. The results show that traditional archival processes are combined with more modern processes such as traceability, interoperability, information security and metadata management. Content analysis was also used in the study Howse et al. (2022) to quantify the arguments put forward to justify support or opposition to laws. It was found that supporters used arguments about crime, safety and health. Opponents of the laws 6 focused on issues such as the 'night-time economy' and the negative impacts of the laws. In contrast, the research Degtyarev (2021) used techniques such as analysis and synthesis, deduction, induction and abduction. They found that the use of modelling makes the process of regulatory experiment more predictable and appropriate by making it more initially calculated.

In the study Yi et al. (2019) semi-structured interviews were conducted with biomedical experts. The findings suggest that some aspects of research integrity need to be elaborated among Chinese biomedical researchers. Data fabrication, data falsification and plagiarism were perceived as the most serious deviations.

A content analysis of laws and standards related to expert witness work will be used to collect and analyze data for the first and second research questions. Subsequently, the method of comparison will be used and the selected countries from the European Union will be compared.

3 Methods and Data

For the first research question, a content analysis of laws and standards related to expert witness activities will be used as a data collection method. More specifically, the website www.ejustice.europa.eu will be used to select five European Union countries and identify their legal requirements for the practice of expert witnessing. These countries will be the Czech Republic, Slovakia, Poland, Belgium and France. This website will be searched for links to the laws and standards of the countries in question, which will be analyzed and compared. The main legal requirements for the practice of expert witnesses will be described, identified through content analysis, and then compared and commented on between the selected countries. In addition, a table will be drawn up of the main aspects and legal requirements that are central to expert activities and then an assessment will be made of which of the selected EU countries has the most demanding legal requirements for the exercise of expert activities and, conversely, which of the selected EU countries has the easiest route to the exercise of expert activities.

For the second research question, a content analysis of laws and standards related to expert witness activities will also be used as a data collection method. Also for this research question, the website www.e-justice.europa.eu will be used, where the same five countries of the European Union will be selected, which are the Czech Republic, Slovakia, Poland, Belgium and France. On this website, content analysis will be used to find references to the laws that regulate the formal and content structure of expert reports. Subsequently, these laws and standards will be used to analyze the current state of the art and to make comparisons between selected European Union countries. A table will also be created to illustrate the differences between the countries and then to evaluate which of the selected EU countries has the most complex formal and content requirements for the structure of expert reports and which of the countries has the simplest formal and content requirements for the structure of expert reports.

4 Results

4.1 Legal requirements for performance of expert activists

For the first research question, a content analysis of laws and standards related to expert witness activities was used as a data collection method. Specifically, five European Union countries were selected from the website www.e-justice.europa.eu and their legal requirements for the practice of expert witnessing were identified. These countries are the Czech Republic, Slovakia, Poland, Belgium and France.

Czech Republic

In the Czech Republic, expert activities are regulated by Act No. 254/2019 Coll., as amended. The registration in the list of experts is regulated by Section 5(1) of the Act on Experts (No. 254/2019 Coll.), as implemented by Decree No. 503/2020 Coll., where the criteria for registration in the list of experts are mentioned. The main criteria for the performance of expert activities include:

- registered office or place of permanent residence in the Czech Republic
- Relevant education (highest education attainable)
- five years of professional experience in the sector
- special education or certificate of professional competence
- Self-empowerment
- integrity (a person who has not been convicted of a deliberate crime or a crime committed negligently in connection with the performance of expert or business activities)
- material technical equipment and facilities
- successful completion of the Ministry of Justice entrance examination
- must not be in bankruptcy
- no revocation of the authorization to carry out expert activities has occurred in the last 5 years
- no fines of more than CZK 100,000 have been imposed in the last 3 years for offences under the Experts Act
- taking the oath

This is not the case with an expert institute or an expert bureau, where special conditions are required under Sections 6 and 7 of the Expert Witness Act. The expert is also obliged to record his/her expert activities electronically in the register of expert opinions organized by the Ministry of Justice. A very important condition for the performance of expert activities is definitely education and experience, since a person who has acquired the required education and length of active professional experience in his/her field and the sector in which he/she specializes becomes an expert. However, there are also expert branches which still require an additional certificate of professional competence in order to perform expert activities. These sectors are defined in Annex 2 to Implementing Decree No 505/2020 Coll. An expert should also continuously develop his/her professional skills and knowledge. Another condition for the performance of expert activities is the compulsory insurance of the expert.

Slovakia

In Slovakia, the Act on Experts, Interpreters and Translators as amended by the implementing decree (Act No. 382/2004 Coll., on Experts, Interpreters and Translators and on Amendments and Additions to Certain Acts) is in force. The main aspects for an expert to be entered in the register are full legal capacity, no criminal convictions, adequate education, seven years' experience in the field and sector, an examination organized by the Ministry of Justice, sufficient material equipment, an oath as an expert witness, and no administrative offences as an expert witness within three years. Compared to the Czech Republic, a specific short-term or long-term course that focuses on the legal norms governing the profession of forensic experts is still considered.

Another very important aspect is the compulsory insurance of liability for damage caused during the performance of expert activities, which is defined in Act No. 382/2004 Coll., as amended, and regulates several types of administrative offences. It is for the liability of experts that the maximum insurance is EUR 33 193. As regards judicial practice, the main legal provisions are Act No 382/2004 Coll., as amended, Decree No 228/2018 Coll., the Code of Civil Procedure, the Code of Criminal Procedure and the Administrative Code. The rules for the appointment of experts for the purposes of proceedings are the same before the civil, criminal and administrative court.

Poland

In Poland, the rules for the appointment of expert witnesses and the performance of their expert activities are laid down in the Act on the Court System and the Decree of the Minister of Justice on Expert Witnesses. Some special procedures, such as expert opinions, are regulated in the Code 10 of Civil Procedure. The main aspects for the performance of expert activities include the age limit of 25 years, theoretical and practical knowledge in a specialized field of technology, art, science or other skills. However, the criteria for the exercise of expert activities are not directly officially established. In this case, it is up to the president of the regional court to decide whether the candidate meets all the requirements for the exercise of expert activities. The main condition is the taking of the oath, as on previous counties. Experts must also comply with the civil, administrative and criminal court rules.

When an expert is registered on the list, he has no obligations, nor does he have to be educated subsequently. They also do not have to be members of a professional organisation and do not have a system of continuing professional development. If a person acts as an expert they are no longer tested on the experience and knowledge they have gained, but the way it works in practice is that if an expert wants to be appointed for a longer term they should demonstrate that they have deepened their knowledge. Experts are not required to have professional indemnity insurance.

Belgium

In Belgium, the status of experts is regulated in Sections 962 to 991 of the Code of Judicial Procedure. Both the court and the parties may call experts. In arbitration proceedings, the procedure for experts is in accordance with Sections 1676 to 1723 of the Code of Judicial Procedure. Belgium has certain criteria for an expert to be entered in the register. The criteria are regulated in Article 555/8, 4 of the Code of Judicial Procedure and the expert must demonstrate both professional competence and legal knowledge. Professional competence is demonstrated, for example, by means of a university degree obtained in the sector in which the applicant is applying for registration as an expert witness. They must also provide evidence of five years' experience in the sector in the last eight years prior to the application. Should the applicant not have a university degree, he must provide evidence of fifteen years' experience in the twenty years prior to the application for registration. There is also an obligation to undertake subsequent training and the obligations are set out in a royal decree where, for example, they undertake to abide by a code of ethics adopted by the King. As for legal

knowledge, this is demonstrated by a certificate after completing an educational course according to the Royal Decree of 30 March 2018. They must then take an oath. The liability of an expert is not defined by law and experts in Belgium are liable according to the rules of civil and contract law.

France

In France, the legislation is contained in Law No. 71-498 of 29 June 1971 on the status of expert witnesses. In the case of France, it is interesting to note that each Court of Appeal and the French Supreme Court (Court of Cassation) keep lists of experts. It is also of great interest that the courts and prosecutors may appoint as an expert any person who is qualified, but in such a case they must state the reasons for this choice. The main conditions for acting as an expert in France are being under 70 years of age, being a citizen of the European Union, being of good repute, not having been subject to administrative or disciplinary sanctions, not having been declared personally bankrupt, having a minimum period of activity with the expert's specialisation, and having to carry out their main activity in the court's circuit. They must also take an oath before being registered as an expert, as was the case in previous countries. If an expert also wants to be listed in the Court of Cassation, he or she must be listed in the Court of Appeal for at least five years. If the expert is listed for the first time, he or she must apply for re-listing after three years, and then only after five years. In addition, experts are required to carry professional indemnity insurance, which covers the professional and civil liability of the expert.

Compare

In the Table 1 is comparison of legal requirements in selected countries of the European Union.

Table 1: Comparison of legal requirements

Country	Education	Practice	Exam	Continuing education	Insurance
Czech Republic	Higher education	5 years	Yes	No	Yes
Slovakia	Corresponding	7 years	Yes	Yes	Yes
Poland	Practical and theoretical knowledge	No	No	No	No
Belgium	Higher education Without diploma	5 years 15 years	No	Yes	No
France	Corresponding	By specialization	No	Yes	Yes

Source: Own

4.2 Content and formal structure of the expert report

Czech Republic

In the Czech Republic, an expert's report must meet the formal requirements set out in Sections 27 and 28 of the Act on Experts (No. 254/2019 Coll.) and in the implementing Decree No. 503/2020 Coll. Every expert's report in the Czech Republic must be complete, truthful and reviewable. From a formal point of view, expert reports must contain a title page, terms of reference, a list of supporting documents, the finding, the opinion, the reasoning to the extent that it is reviewable, the conclusion, the annexes, the expert clause, the expert seal and the signature (if the report is in electronic form, there must be a qualified electronic signature).

The expert opinion must be prepared by the expert only in person and in the field and specialisation in which he is authorised. It must be prepared with professional care, independently, impartially and within the agreed or specified time limit. Experts in the Czech Republic are not obliged to give preliminary opinions, nor are they obliged to go beyond the terms of reference in an opinion if argued by the parties. Experts are bound by confidentiality in the context of their expert activities. An expert in the Czech Republic may refuse to provide an expert report for the reasons set out in section 19 of the Expert Witness Act. An expert report should be submitted in

written form, but the law allows, with the consent of the commissioner of the report, the submission of an expert report in oral or electronic form. The court may also ask the expert to supplement or further explain his/her expert report.

Slovakia

In Slovakia, the formal requirements for expert reports are determined by Section 17 of Act No.382/2004 Coll. Courts are not bound by expert reports and an expert report has exactly the same meaning as any other evidence.

Formally, the expert report must include a title page, introduction, report, conclusions, appendices and provisions on expertise. As in the Czech Republic, experts do not have to submit a preliminary report or address the arguments of the parties. The court may also order the expert to prepare a supplementary report. Expert reports in Slovakia are submitted in written form or orally.

Poland

In Poland, this issue is quite different, as there are no formal requirements for a specific structure of expert reports that experts have to follow. Experts do not have to submit a written expert report and in the report the expert is not obliged to comment on the arguments of the parties. In most cases, supplementary reports are also required to be documented, as it happens that not all questions from the terms of reference are answered or the court has additional questions. Experts are not obliged to provide preliminary reports. The parties to the court proceedings may request a supplementary expert report if they have additional questions for the expert. Experts are always obliged to attend the court hearing after the expert report has been prepared and may be cross-examined.

Belgium

In Belgium, the status of experts is regulated in Sections 962 to 991 of the Code of Judicial Procedure. In arbitration proceedings, the procedure for experts is in accordance with Sections 1676 to 1723 of the Code of Judicial Procedure. In the case of expert evidence, the court has the option of deciding whether expert evidence is necessary for the litigation. The judge is not bound by the expert's report. The expert must prepare the expert report in accordance with the court's instructions and in civil proceedings the court supervises the course of the expert report. It also ensures that all deadlines are met. An expert report in Belgium must contain introductory information, independent work and the findings and conclusions that the expert has made during the preparation of the report. The report must also include all documents used by the expert in its preparation. The parties may challenge the report in court and may submit their own report. The expert may be contacted by both parties to the proceedings during the preparation, provided that the communication takes place in the presence of both parties. The court may order the expert to supplement the report or to prepare another expert report.

France

In France, the Code of Criminal Procedure and the Code of Civil Procedure, Law 71-498 of 29 June 1971 on expert witnesses, which has been amended several times, notably on 18 November 2016, and the Decree of 23 December 2004, amended several times, regulate expert reports. During the preparation of the expert report, the expert may be in contact with the parties, but must respect the principle of adversarial proceedings (there are exceptions for medical or commercial confidentiality). An essential prerequisite for adversarial proceedings is that both parties to the 14 proceedings are on an equal footing and thus have an equal opportunity to defend their positions before an impartial tribunal.

As regards the formal or content structure, there is no prescribed structure of expert reports. However, in his report, the expert must clearly specify the documents on the basis of which he formed his opinion, he must respond to the parties' statements,

he must discuss his reasoning in detail and he must list all the documents submitted to him. The court shall control the course of the expert's investigation and may require a preliminary report, which the expert must send to the parties to the proceedings. In criminal proceedings, the expert must attend the hearing, in civil proceedings the court may request the expert to attend the hearing and the court may also order a supplementary report. In civil proceedings, a preliminary report is not mandatory, but is usually recommended and required. Experts submit written reports.

Compare

In the Table 2 is comparison of the content and formal structure of expert reports in selected countries of the European Union.

Table 2: Comparison of the content and formal structure of expert reports

Country	Formal structure	Content structure	Method of administration	Preliminary opinion
Czech Republic	Yes	Yes	In writing Electronically Orally	No
Slovakia	Yes	Yes	In writing Orally	No
Poland	No	No	In writing	No
Belgium	Yes	Yes	In court	No
France	No	No	In writing	Often required

Source: Own

5 Discussion

What are the legal requirements for the practice of expertise in selected EU countries?

This research question used a content analysis of laws and standards related to expert witness activities as a method of data collection. Compared to the research Reid & Howes (2020), a wider range of laws were used using content analysis. Five countries were selected, namely the Czech Republic, Slovakia, Poland, Belgium and France. The key legal requirements for the practice of expert witnessing that were identified by the content analysis were described. Furthermore, Table 1 has been drawn up, which mentions the main aspects and legal requirements that are central to expert activities.

Table 1 shows that the Czech Republic has some of the most comprehensive requirements of the selected countries, as does Slovakia. The longest professional experience requirements are in Belgium; if the applicant for registration as an expert does not have a university degree, he or she must demonstrate 15 years of experience. If they do, the requirement is only 5 years of professional experience. In Slovakia, the professional experience requirement is 7 years with a relevant degree. In the Czech Republic, the emphasis is on education, which should be as attainable as possible. There are also requirements for an entrance examination, as in Slovakia. In the case of France, both education and experience depend on the specialisation of the sector in which the applicant is applying for registration. However, there is no need for an entrance examination, as in the case of Belgium and Poland. Only Poland does not require further training, the other selected countries do. Similarly, Poland does not require professional indemnity insurance.

It is thus clear from the table that Poland has the easiest route to expert witness practice, as the criteria for expert witness practice are not directly established officially. In this case, it is up to the president of the regional court to decide whether the candidate fulfils all the requirements to practise as an expert. On the other hand, the Czech Republic and Slovakia have the most difficult path to practise as an expert, with a strong emphasis on the entrance examination and subsequent training.

What are the primary differences in the content and formal structure of expert reports in selected EU countries?

For the second research question, a content analysis of laws and standards related to expert witness activities was also used as a

data collection method. The same five countries of the European Union were selected for this research question, which are the Czech Republic, Slovakia, 16 Poland, Belgium and France. A table was also created to illustrate the differences between the countries in the formal and content structures of expert reports. Compared to the study Shaboltas et al. (2020) all the formal and content requirements of expert reports in the countries were analysed.

Table 2 shows that experts in the Czech Republic, Slovakia and Belgium are obliged to follow the formal and content structure. In the case of France, the expert must clearly specify in his report the documents on the basis of which he has based his report, he must respond to the parties' statements, he must discuss his reasoning in detail and he must list all the documents submitted to him. There are no formal requirements for Poland. The submission of the opinion depends on the court but, in most cases, they require written opinions. For the countries examined, the expert is not obliged to provide a preliminary report, but in the case of France, in most cases it is recommended and required.

Thus, it is clear from the table that Poland has the least extensive requirements for the preparation of an expert report, as there is no formal or substantive structure in Poland, no need to submit a preliminary report, and the method of submission is in writing. In contrast, the Czech Republic and Slovakia have the most comprehensive requirements, as both countries have requirements for a precise formal and content structure. However, among these countries, the Czech Republic has the more demanding formal requirements, as expert reports must include a cover page, terms of reference, a list of supporting documents, the finding, the opinion, the reasoning to the extent that it is reviewable, a conclusion, annexes, an expert clause, an expert seal and a signature. In the case of Slovakia, it is only the title page, introduction, report, conclusions, annexes and expert clause.

6 Conclusion

The aim of this article was to evaluate, analyze and compare the expert and the status of the expert in selected EU countries, specifically the legal requirements for the performance of expert activities in selected EU countries, the primary differences in the content and formal.

The aim of the work was completely fulfilled. Five countries were selected, namely the Czech Republic, Slovakia, Poland, Belgium, and France. The key legal requirements for the performance of expert activities were described and the content analysis revealed that the Czech Republic has one of the most comprehensive requirements for the performance of expert activities among the selected countries, as does Slovakia.

Furthermore, similarities and differences were found in the content and formal structure of expert reports in the above mentioned selected countries and their legislation. Higher requirements for the formal and content structure of expert reports are imposed on experts in the Czech Republic, Slovakia and Belgium.

The work has been limited to a selected sample of national legislations, so there is room for further development of this topic across other selected countries.

Literature:

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Primary Paper Section: A

Secondary Paper Section: AG

CHANGES IN MOTOR PERFORMANCE IN EARLY SCHOOL-AGED ROMA CHILDREN

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Abstract: In their contribution, the authors approach the issue of the movement performance of Roma children of younger school age by following the trends in the development of somatic and movement characteristics over a 20-year period. Our research was attended by (668 children) from elementary schools from five cities in the East Slovak region. The aim of the contribution is to identify the current state and level of somatic and motor characteristics of Roma children in primary education in primary schools of the East Slovak region in relation to age and gender. To determine the level of movement skills, we used selected tests from the EUROFIT battery. We compared the achieved research results of all children in our research (File: R 2019) with the research results of twenty years ago (Horváth: R 2001). By analyzing and comparing the results, we point out development trends after a 20-year period and at the same time provide an analysis of the causes of possible changes.

Keywords: Diagnosis, somatic and motor characteristics, EUROFIT-test, movement skills, coordination skills, comparison, younger school age.

1 Introduction

We cannot imagine life in our schools without adequate physical activity. The child should be led to movement activities from a young age, because the first habits are already formed during this period. Children perceive their parents as role models, and when they notice that their parents are not interested in physical activity, we can assume that the child will also imitate their attitude. Knowing the state of movement abilities of children of younger school age in primary education contributes significantly to its positive influence in terms of prevention and the goal of the set requirements for children. By looking for effective models for the development of movement skills in physical and sports education, we will help children discover the benefits of movement activities and the possibilities of enjoying them. Their development should take into account and respect the age and individuality of each child. According to the author Ogden et al. (2012) the behavior and characteristics of today's children together with their genetics are determinants of their growth and development which affects their physical, mental and psychosocial health and their physical and cognitive performance. The technological progress of modern society has contributed to a sedentary lifestyle, which has changed the phenotype of children compared to the phenotype of 20 years ago. Today's children weigh more and have a higher body mass index (BMI) than their peers just a generation ago.

The authors (Güngör, 2014, Maile et al., 2015) state that an alarming increase in the prevalence of childhood overweight and obesity has been observed in recent decades, which is partly attributed to a lack of physical activity and has begun to become a public health problem. Reduced levels of physical activity in children lead to overweight or obesity, while excess energy intake together with unhealthy eating habits, and also a combination of both, leads to an excess of energy.

According to the author Abel et al. (2018) there are research findings that suggest high levels of obesity have a negative impact on physical fitness parameters. Research suggests that health-related fitness parameters - such as BMI, body composition parameters and flexibility - may vary with different levels of obesity and physical activity. Recently, a new generation of video games that require the body to move while playing is gaining popularity among researchers who hope to

find effective approaches to solving the epidemic of childhood physical inactivity that is leading to the childhood obesity crisis.

In the US, the obesity crisis is evident in many health surveillance data sets (Sun, 2013). For example, the author Zapata et al. (2008) estimated that obesity rates have tripled since 1980 among youth ages 6-11. The rise of childhood obesity has become the biggest threat to health as research has shown that more than half of obese children will become obese adults in their lifetime. Many factors were identified as contributing to the obesity crisis. Sedentary activities are one of the most significant of them. Today, children and adolescents spend most of their free time in sedentary activities, such as watching television for hours, surfing the Internet continuously using a computer, or playing video game consoles non-stop. As children and adolescents are more likely to spend their free time in sedentary activities, active video games that allow players to physically manipulate and interact with the game show potential to engage youth in physical activity.

We believe that among the factors that influence the entire process of motivating children to physical education and sports are primarily the quality and quantity of understandable information in everyday life, the climate of school and home, the teacher, coach and family, but also the child himself. According to the author Horváth et al. (2010) somatic and movement testing has a wide scope and at the same time affects the individual, school, region, education and health departments, their orientation, with important goals for a healthy lifestyle for the whole society. The author Šimonek (2018) is of the opinion that when determining children's talent for sports, not only the level of motor skills should be monitored, but also the level of motor competences manifested in basic movements such as walking, running, jumping, throwing, rolling a ball, jumping rope, jumping over an obstacle etc. The state of gross motor skills usually reveals the quality of children's motor skills more than performance in tests of motor skills.

Several authors, e. g. Antala et al. (2018), Horváth et al. (2016), Merica & Barnáková (2021), Belešová (2022), Merica & Belešová (2022), Severini, E., Kožík Lehotayová, B., & Kuruc, M. (2020) Severini, Kožuchová & Brezovská (2021), Koreňová, Severini & Čavojský (2023) emphasize that teachers significantly influence the development of education system, upbringing and education itself. The importance of the teaching profession affects all areas of society's life. According to the authors Gunčaga, Žilková & Partová et al. (2019), Gunčaga & Belešová (2023), Kostrub (2022) Porubčanová & Zapletal (2022), Horecký, J., & Koreňová (2023) the teacher influences the character and quality of the relationship with the students, conditions the atmosphere in the classroom, stimulates the students' interest - including their relationship to sports and active physical activity, their experience of life at school, development of their knowledge and their entire personality. Other authors, e. g. Gregor (2013), Horváth (2001), Kampmiller & Vanderka et al. (2012), Petrikán (2021), Turek (1999) recommend physical activities as part of a healthy lifestyle and emphasize the need for regular exercise in children from the earliest school age.

2 Methodology

Goal. The goal of the contribution is to find out and identify the state of level of somatic and motor characteristics of Roma children of younger school age from elementary schools in cities, villages and settlements in the East Slovak region and to find out the trends of their development by comparing our research (File: R 2019) with research from twenty years ago (Horváth: R 2001) and try to analyze the causes of the development based on the comparison. To determine the level of motor skills, we used selected tests from the EUROFIT by Moravec et al. (2002).

Tasks. Based on the goal we set, we set the following tasks: Select elementary schools in the East Slovak region where we will carry out our research, instruct teachers and explain the methodology of testing children. Select the test items from the EUROFIT-test that we will use during testing. Carry out planned testing of Roma children of younger school age in six primary schools in the East Slovak region. To compare the results of our research (File: R 2019) carried out on (668) Roma children of the Eastern Slovak region with the results of research (Horváth: R 2001), which was realized on (1093) Roma children of the Eastern Slovak region, of which there were (550) boys and (543) girls. Statistically process and evaluate the measured results.

Hypotheses. On the basis of the goal and tasks of the work, we set up the following hypotheses (H0-1, H1-1, H0-2, H1-2):

H0-1: We assume that there will be no statistically significant difference in somatic characteristics between the results of the Roma children from the research (Horváth: R 2001) and the results of the Roma children from our research (File: R 2019).

H1-1: We assume that between the results of the Roma children from the research (Horváth: R 2001) and the results of the Roma children from our research (File: R 2019) there will be a statistically significant difference in somatic characteristics in favor of the children from our research (File: R 2019).

H0-2: We assume that there will be no statistically significant difference between the results of the Roma children from the research (Horváth: R 2001) and the results of the Roma children from our research (Súbor: R 2019) in the individual tests of motor characteristics.

H1-2: We assume that there will be a statistically significant difference between the results of the Roma children from the research (Horváth: R 2001) and the results of the Roma children from our research (File: R 2019) in the individual tests of motor characteristics, and the results of the Roma children from our research (File: R 2019) will be better.

Characteristics of the research object: Our research (File: R 2019) was attended by (668) Roma children of younger school age from six primary schools (ZŠ) of the East Slovak region in the cities, villages and settlements: Sobrance, Vranov n/Topľou, Rudňany, Veľké Kapušany, Jarovnice and Bardejov. Of these, there were (379) boys and (289) girls. They were students of the first, second, third and fourth grades. In our research (File: R 2019) we included: 7, 8, 9 and 10-year-old Roma children of younger school age, while for 7-year-olds we consider the decimal age 7.00-7.99, for 8-year-olds the decimal age 8.00-8.99, for 9-year decimal ages 9.00-9.99 and for 10-year decimal ages 10.00-10.99.

Methods of data acquisition: We chose the following tests to determine the data we are tracking.

For somatic characteristics, we chose: 1. TV (body height), 2. TH (body weight), 3. BMI (Body Mass Index).

For motor characteristics, we selected the following items from the EUROFIT test:

1. Test (PRKL) –Forward bending with reaching while sitting. Factor: joint mobility and flexibility of the body of the sitting part of the body and the back of the legs.

2. Test (SKOK) – Long jump from a place. Factor: explosive power of the lower limbs.
3. Test (LS) – Sit up in 30s. Factor: dynamic and endurance strength of the abdominal, hip and thigh muscles.
4. Test (VZH) – Pull-up. Factor: static, endurance strength of the muscles of the upper body.
5. Test (CBEH) – Shuttle run 10 x 5m. Factor: running speed with changes of direction.
6. Test (VBEH) – Endurance shuttle run. Factor: running endurance.

Methods of processing and evaluating the results: We statistically processed and evaluated the measured data. We digitized the measured values recorded in the recording sheets as an input database, which we processed using the EXCEL program from the Microsoft Office package. The first step, before processing the research data, was the exclusion of extreme values (outliers). We evaluated somatic indicators using percentile charts. Since we want to test hypotheses about the statistical significance of file differences, we had to decide what type of test to use. When deciding between parametric and non-parametric tests, the deciding factor is the normality of the sets and whether the variances of the sets are not significantly different. We tested normality with the Shapiro-Wilk normality test, and variances were tested with the F test. Since normality was confirmed and the results of the F test did not show significant differences in the variances, we used the parametric T test, the so-called "one simple t test", to test the hypotheses. The formula that this t test is based on is

$$t = \left(\frac{x_{1999} - x_{2019}}{s} \right) \sqrt{n}$$

where x_{1999} and x_{2019} (are the arithmetic means of the sets), s (is the standard deviation), n (is the number of probands in the set). We compared the calculated value of t at the assumed level of significance $\alpha=0.05$ with the table value of the Student's distribution at $n-1$ degrees of freedom t_{crit} . If $t > t_{crit}$, we reject the null hypothesis H_0 and accept the alternative hypothesis H_1 . The use of several statistical methods can also be found in the authors Hendl (2006), Tomšík (2017), Gunčaga, Zawadowski, Prodromou (2019) and others.

3 Results and discussion

Obtained results from the testing of somatic indicators and motor movement skills of Roma children of younger school age ($n = 668$) from six primary schools in the East Slovak region (in cities, villages and settlements: Sobrance, Vranov n/Topľou, Rudňany, Veľké Kapušany, Jarovnice and Bardejov), we present in tables and graphs taking a position on the individual four hypotheses. We note that the primary schools in Rudňany and Jarovnica are attended exclusively by children from the surrounding settlements. There were (379) boys and (289) girls in the group we monitored. They were students of the first, second, third and fourth grades. In Tab. (1) we present the number and composition of our monitored file of Roma children (File: R 2019) in the number of 668 children.

Tab. 1: Number and composition of files of Roma children ($n=668$) of younger school age: (File: R 2019)

	Boys					Girls					Sum
	7th	8th	9th	10th	Sum	7th	8th	9th	10th	Sum	
ZŠ Sobrance	15	15	15	15	60	15	15	15	15	60	120
ZŠ Vranov n/Topľou	15	13	9	18	55	16	17	14	17	64	119
ZŠ Rudňany	15	15	15	15	60	14	30	15	15	74	134
ZŠ Veľké Kapušany	19	20	20	11	70	22	15	20	20	77	147
ZŠ Jarovnice	15	15	15	15	60	15	15	15	15	60	120
ZŠ Bardejov	19	23	15	17	74	10	10	16	9	45	119
	98	101	89	91	379	92	102	95	91	289	668

3.1 Somatic characteristics of Roma children of younger school age

Approximately 450,000 Roma live in Slovakia, most of them in eastern Slovakia. If in the majority society there are 12% of children, in the Roma population it is 46% of children. This issue significantly affects a wide range of current and future problems of members of marginalized Roma communities - we mean the interrelationship between health status, socio-economic

situation, school success and, consequently, applicability on the labor market, etc. Similar research has not yet been carried out in Slovakia in a long-term perspective. In the following tables (Tab. 2, 3) we present the somatic characteristics of Roma children of younger school age in our monitored group (File: R 2019) in number ($n = 668$), which we also specified for the category of 7- and 8-year-old children and for the category for 9- and 10-year-old Roma children.

Tab. 2: Somatic characteristics of Roma children of younger school age (7 and 8 years old): (File: R 2019)

Age			7						8					
			n	x	s	T	tkrit	T-test	n	x	s	T	tkrit	T-test
TV	B	2001	135	115,59	6,30	8,53	1,993	**	142	121,09	5,31	7,69	1,990	**
		2019	72	122,35	6,72				74	127,22	6,80			
	G	2000	136	114,84	6,71	8,91	1,990	**	132	120,47	6,40	7,79	1,987	**
		2019	74	120,12	5,90				87	125,86	6,45			
TH	B	2001	135	20,92	2,39	7,69	1,993	**	142	23,18	2,91	7,26	1,993	**
		2019	72	24,45	3,80				74	28,68	6,86			
	G	2001	136	20,78	3,10	5,69	1,993	**	132	22,64	3,00	8,74	1,950	**
		2019	74	22,10	2,89				87	26,75	4,38			
BMI	B	2001	135	15,66	1,51	8,49	1,993	**	142	15,81	1,56	5,25	1,993	**
		2019	72	16,29	1,80				74	17,62	2,94			
	G	2001	136	15,66	1,69	2,84	1,992	**	132	15,75	1,27	5,46	1,980	**
		2019	74	17,44	2,56				87	18,36	1,56			

Legend: n (number of tested probands), x (arithmetic mean of values), s (standard deviation), T (calculated value from the T-test), $tkrit$ (critical table value of Student's distribution at $n-2$ degrees of freedom), ** (statistically significant difference of the T-test at the level of 0.05%).

Tab. 3: Somatic characteristics of Roma children of younger school age (9 and 10 years old): (File: R 2019)

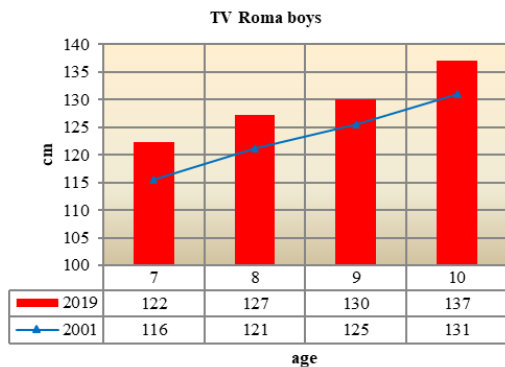
Age			9						10					
			n	x	s	T	tkrit	T-test	n	x	s	T	tkrit	T-test
TV	B	141	125,43	5,80	5,50	1,994	**	132	130,96	1,60	6,83	1,940	**	
		72	130,14	7,21				72	137,06	7,52				
	G	133	124,50	6,56	7,87	1,993	**	141	130,23	7,30	10,33	1,990	**	
		74	130,57	6,58				77	139,85	8,40				
TH	B	141	24,94	4,53	7,94	1,994	**	132	27,4	4,70	7,34	1,994	**	
		72	32,04	7,54				72	35,93	10,2				
	G	133	24,31	3,56	7,67	1,993	**	141	27,4	4,80	9,82	1,990	**	
		74	29,95	6,24				77	36,25	8,17				
BMI	B	141	15,78	2,20	7,167	1,994	**	132	15,85	1,94	6,76	1,954	**	
		72	18,75	3,55				72	18,87	3,77				
	G	133	15,66	1,85	5,41	1,993	**	141	15,85	1,82	9,15	1,990	**	
		74	17,44	6,70				77	18,37	2,40				

Legend: n (number of tested probands), x (arithmetic mean of values), s (standard deviation), T (calculated value from the T-test), $tkrit$ (critical table value of Student's distribution at $n-2$ degrees of freedom), ** (statistically significant difference of the T-test at the level of 0.05%).

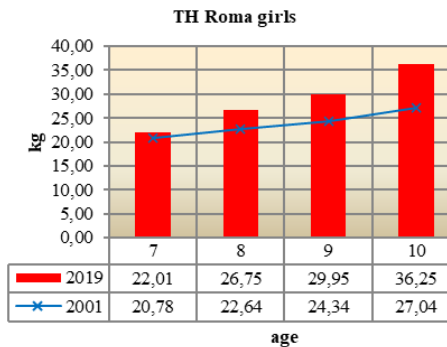
By testing the hypotheses with the Student's T-test, we verified the hypothesis H_0-1 that there will be no statistically significant differences between the results of our research (File: R 2019) and the results of the research (Horváth: R 2001). When analyzing the results of the T-test (Tab. 2, 3), we can state that the results of the T-test disproved this hypothesis and confirmed

statistically significant differences in somatic characteristics in both Roma boys and girls in all age groups of the research (File: R 2019). We will graphically discuss these differences with the help of a graphic representation.

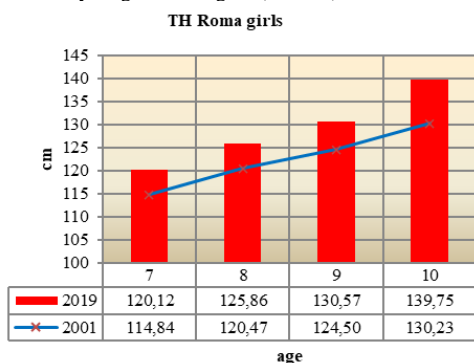
Graph 1: Body height: Roma boys (n = 379)



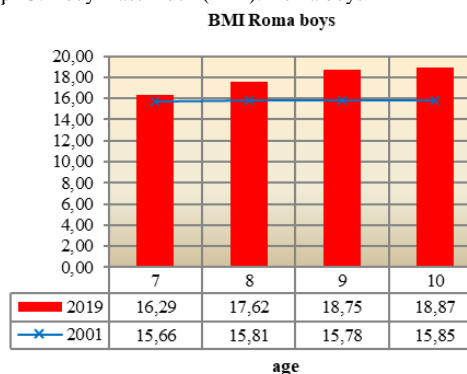
Graph 4: Body weight: Roma girls



Graph 2: Body height: Roma girls (n = 289)

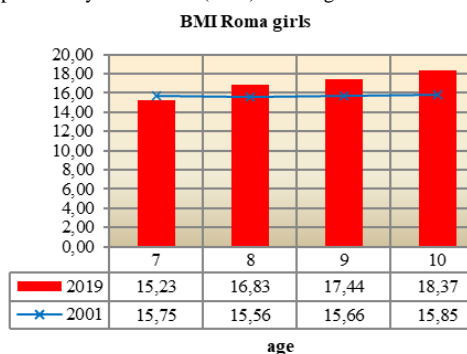


Graph 5: Body mass index (BMI): Roma boys

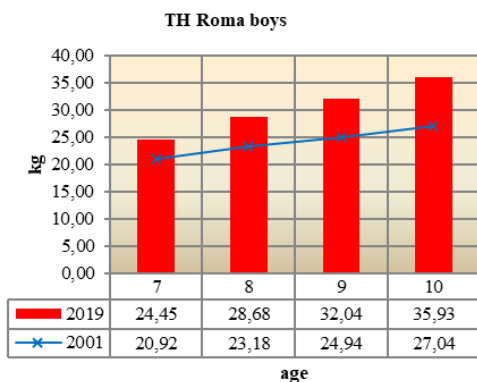


When analyzing the values (Graph 1, 2) of the somatic characteristic: Body height (TH), we see that the Roma boys from our research (File: R 2019) are taller than the Roma boys from the research (Horváth: R 2001) in all age categories and it is on average up to 6 cm. In the research (Horváth: R 2001) we see that the lag behind the majority population was up to 3 years. Today, although Roma boys are shorter than their peers, this lag is no longer so striking and is also genetically conditioned. The same applies to Roma girls. The biggest difference is observed in 10-year-old girls, where this difference is up to 9 cm.

Graph 6: Body mass index (BMI): Roma girls



Graph 3: Body weight: Roma boys



When analyzing Body Weight (TH) monitoring, it is significant (Chart 3, 4) that the differences between both sets of Roma children, boys and girls, increase with increasing age. The author (Horváth: R 2001) states that Roma children lag behind their peers from the majority society by 2 to 3 years. In our research, we see that in higher age categories, the differences decrease. For 10-year-old boys and girls (File: R 2019), the difference compared to their peers (Horváth: R 2001) is up to 8 kg. Of course, this fact (Chart 5, 6) is also reflected by the Body mass index (BMI). While 10-year-old boys and girls in the research (Horváth: R 2001) were on the percentile graph in the malnutrition zone, boys and girls (File: R 2019) are in the 20th percentile.

3.2 Evaluation of motor tests

In the following tables (Tab. 4, 5) we present the motor characteristics of Roma children of younger school age (n=668) of our monitored group (File: R 2019), which we also specify for

Roma children of younger school age (7 and 8 years old) and Roma children of younger school age (9 and 10 years old).

Tab. 4: Motor characteristics of Roma children of younger school age (7 and 8 years old): (File: R 2019)

Age			7						8					
			n	x	s	T	tkrit	T-test	n	x	s	T	tkrit	T-test
PRKL	B	2001	135	11,31	5,10	5,30	1,990	**	142	15,43	6,33	9,22	1,990	**
		2019	72	19,59	6,53				74	18,71	5,34			
	G	2001	136	18,79	5,47	9,26	1,990	**	132	19,41	5,30	14,11	1,990	**
		2019	74	13,83	5,49				87	14,83	5,40			
SKOK	B	2001	135	94,46	19,20	4,65	1,990	**	142	106,34	17,61	5,50	1,990	**
		2019	72	83,13	20,70				74	116,30	16,83			
	G	2001	136	81,50	17,10	2,35	1,990	**	132	95,99	16,59	3,49	1,990	**
		2019	74	76,31	18,95				87	102,55	17,62			
LS	B	2001	135	10,17	4,29	1,14	1,990		142	12,25	4,49	8,81	1,990	**
		2019	72	9,60	4,25				74	16,24	3,87			
	G	2001	136	7,54	3,93	0,21	1,990		132	9,17	4,72	12,20	1,990	**
		2019	74	7,61	2,95				87	14,28	3,91			
CBEH	B	2001	135	39,21	5,89	8,49	1,990	**	142	28,99	5,85	4,90	1,990	**
		2019	72	25,75	5,49				74	25,32	3,50			
	G	2001	136	39,21	4,64	12,7	1,990	**	132	30,68	6,71	13,73	1,990	**
		2019	74	29,66	6,47				87	25,35	3,62			
VBEH	B	2001	135	11,48	4,57	3,90	1,990	**	142	17,31	11,54	4,90	1,990	**
		2019	72	13,39	5,24				74	14,14	5,53			
	G	2001	136	11,48	3,19	1,48	1,990		132	13,10	4,55	1,49	1,990	
		2019	72	10,71	4,05				72	13,81	4,65			

Legend: n (number of tested probands), x (arithmetic mean of values), s (standard deviation), T (calculated value from the T-test), tkrit (critical table value of Student's distribution at n-2 degrees of freedom), ** (statistically T-test significant difference at the 0.05% level)

The motor tests in the tables (Tab. 4, 5) and in the graphs (Graph 1 - 12) are marked with abbreviations that mean: 1. Test (PRKL): Forward bending with reaching while sitting. 2. Test

(JUMP): Long jump from a place. 3. Test (LS): Sit up in 30 seconds. 4. Test (VZH): Pull-up. 5. Test (CBEH): Shuttle run 10 x 5m. 6. Test (RUN): Endurance shuttle run.

Tab. 5: Motor characteristics of Roma children of younger school age (9 and 10 years old): (File: R 2019)

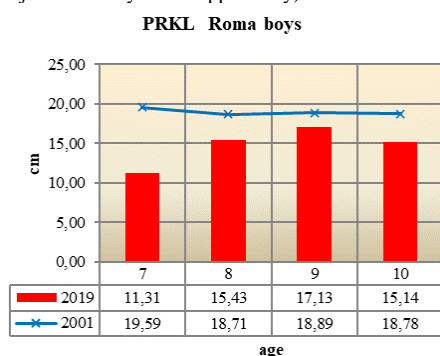
Age			9						10					
			n	x	s	T	tkrit	T-test	n	x	s	T	tkrit	T-test
PRKL	B	2000	141	18,89	4,98	1,86	1,990		132	18,78	4,25	3,47	1,990	**
		2019	72	17,13	7,95				72	15,14	8,82			
	G	2000	131	18,12	4,32	2,96	1,990	**	141	18,78	4,50	3,64	1,990	**
		2019	74	15,35	7,97				77	15,39	8,12			
SKOK	B	2000	141	108,34	22,44	0,373	1,990		132	108,51	19,84	3,92	1,990	**
		2019	72	107,60	16,50				72	117,06	18,34			
	G	2000	131	97,75	15,31	2,98	1,990	**	141	108,51	16,90	1,49	1,990	
		2019	74	97,65	17,27				77	105,51	20,25			
LS	B	2000	141	14,21	4,90	4,49	1,990	**	132	12,13	4,74	13,27	1,990	/**
		2019	72	16,56	4,39				72	18,65	4,14			
	G	2000	131	11,69	4,86	5,41	1,990	**	141	12,13	4,46	8,85	1,990	**
		2019	74	14,38	4,24				77	16,57	4,36			
VZH	B	2000	141	13,84	10,90	0,07	1,990		132	8,67	6,50	7,93	1,990	**

		2019	72	13,91	8,16				72	19,15	11,13			
	G	2000	131	7,76	4,64	0,35	1,990		141	8,67	5,66	2,95	1,990	**
		2019	74	7,55	4,94				77	11,79	9,21			
CBEH	B	2000	141	27,35	6,12	7,47	1,990	**	132	28,83	5,12	17,71	1,990	**
		2019	72	23,85	3,95				72	22,22	3,15			
	G	2000	131	29,74	5,77	9,19	1,990	**	141	28,83	5,79	13,89	1,990	**
		2019	74	25,79	3,76				77	24,52	2,71			
VBEH	B	2001	141	14,57	3,70	2,3	1,990	**	132	18,17	5,22	2,56	1,990	**
		2019	72	15,23	4,50				72	17,50	3,89			
	G	2001	131	14,17	5,20	3,5	1,990	**	131	18,17	4,89	3,15	1,990	**
		2019	74	14,23	4,80				74	16,13	3,15			

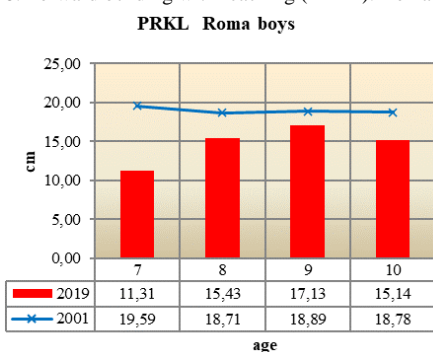
Legend: n (number of tested probands), x (arithmetic mean of values), s (standard deviation), T (calculated value from the T-test), tkrit (critical table value of Student's distribution at n-2 degrees of freedom), ** (statistically T-test significant difference at the 0.05% level)

In the next part (Chart 7 - 12) we present the results of individual motor tests of Roma children (Roma boys and Roma girls) of younger school age, including the attitude towards individual hypotheses.

Graph 7: Forward bending with reaching (PRKL): Roma boys (factor - joint mobility of the upper body)

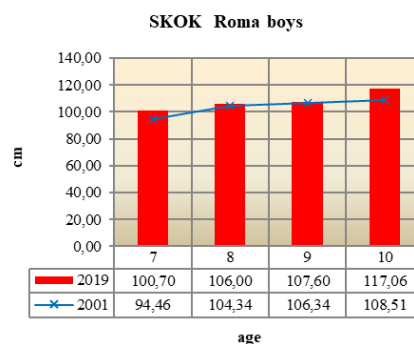


Graph 8: Forward bending with reaching (PRKL): Roma girls

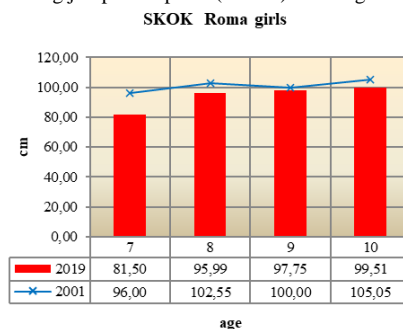


In the test item: Forward bending with reaching in a sitting position (PRLK), which represents the joint mobility of the upper body, we observe large differences between the measurement (Horváth: R 2001) and our research (File: R 2019). The biggest differences are for boys and girls in the 7-year-old and 10-year-old age categories (Graph 7, 8). We do not have an explanation for this situation, we believe that there may also have been non-compliance with the measurement methodology (e. g. failure to bend the knees during measurement).

Graph 9: Long jump from place (SKOK): Roma boys (factor - explosive power of the lower limbs)

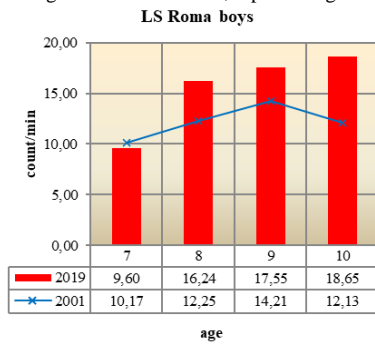


Graph 10: Long jump from place (SKOK): Roma girls

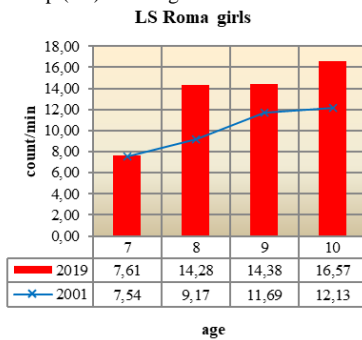


Long jump from the place (SKOK): this test evaluates the explosive strength of the lower limbs. For boys, there are statistically significant changes in all age categories except for 9-year-old boys. In all age categories (Graph 9, 10), boys from our research have better results (File: R 2019). The situation is different for girls, in all age categories girls achieved better average values from the measurement (Horváth: R 2001).

Graph 11: Sit up (LS): Roma boys (factor - dynamic and endurance strength of the abdominal, hip and thigh muscles)

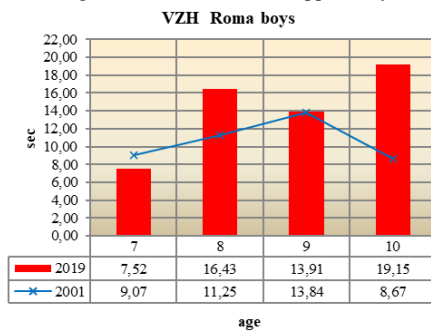


Graph 12: Sit up (LS): Roma girls

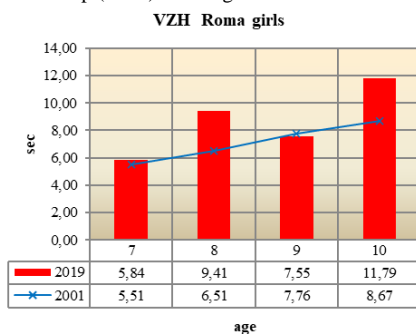


With the test item: Sit up (LS), we test the dynamic and endurance strength of the abdominal and hip-thigh muscles. When analyzing the results (Graph 11, 12), we can state that in the age category of 7-year-old boys and girls, the results of both studies are almost identical. In the age category of 8, 9 and 10-year-old boys and girls, the probands of our research have statistically significantly better results (File: R 2019). We noticed the biggest differences in 10-year-old boys and girls.

Graph 13: Pull-up (VZH): Roma boys (factor - static and endurance strength of the muscles of the upper body)



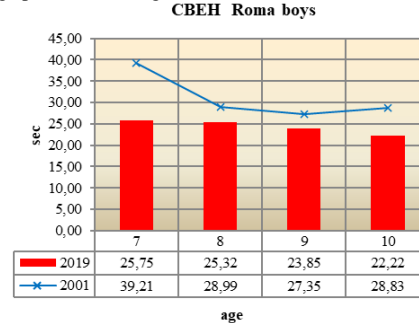
Graph 14: Pull-up (VZH): Roma girls



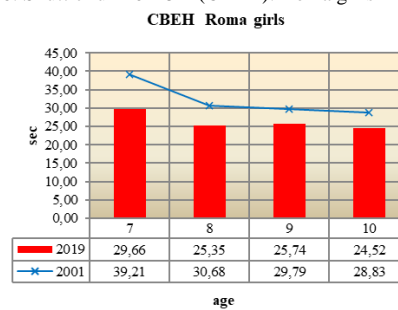
Pull-up (VZH) evaluates the static and endurance strength of the muscles of the upper body. Even in this test item (Graph 13, 14)

we see minimal differences in both 7-year-old boys and girls between the monitored groups. We noted the biggest differences in 8- and 10-year-old boys and girls. In these age categories, the probands from the research achieved significantly better results (File: R 2019).

Graph 15: Shuttle run 10 x 5m (CBEH): Roma boys (factor - running speed with changes of direction)

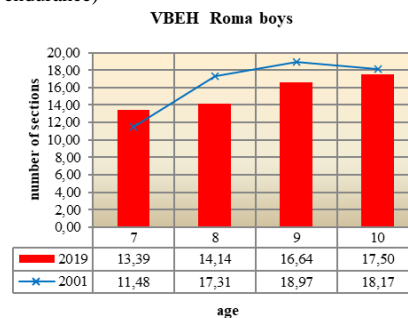


Graph 16: Shuttle run 10 x 5m (CBEH): Roma girls

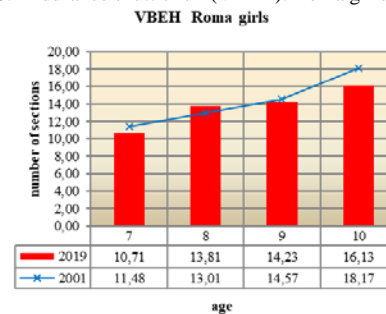


When analyzing this test item: Shuttle run 10 x 5m (CBEH), which characterizes running speed with changes of direction (Graph 15, 16), it is clear that better results were achieved by children from the research (File: R 2019) in all age groups in boys also in girls compared to research (Horváth: R 2001).

Graph 17: Endurance shuttle run (VBEH): Roma boys (factor - running endurance)



Graph 18: Endurance shuttle run (VBEH): Roma girls



Test item: Endurance shuttle run (VBEH), which represents running endurance ability (Graph 17, 18). Here we recorded the

following results: in the category of 7-year-old boys, better results were achieved by boys from the research (File: R 2019), in other age categories better results were achieved by Roma boys from the research (Horváth: R 2001). For Roma girls, 7, 9 and 10-year-old girls from the research ran more sections (Horváth: R 2001), only in the 8-year-old category did the girls from the research achieve better results (File: R 2019).

3.3 Opinion on hypotheses and discussion

In the null hypothesis H0-1, we assumed that there would be no statistically significant differences in the somatic characteristics between the results of the somatic characteristics of Roma children from the research (Horváth: R 2001) and the results of our research (Súbor: R 2019). We disproved this hypothesis with a T-test and the alternative hypothesis H1-1 is valid, that there are statistically significant differences in the somatic characteristics of the children from the research (Horváth: R 2001) and the results of our research (File: R 2019), which applies to all age categories for both boys and girls. Roma children of younger school age from our research (File: R 2019) have a higher weight, height and Body mass index (BMI) than Roma children from research (Horváth: R 2001).

In the null hypothesis H0-2, we assumed that there would be no statistically significant differences between the results of the children from the research (Horváth: R 2001) and the results of our research (File: R 2019) in the tests of motor characteristics in the individual test items. This hypothesis was unequivocally refuted by the T-test, and the alternative hypothesis H1-2 is valid, that between the results of the Roma children from the research (Horváth: R 2001) and the results of the Roma children from our research (File: R 2019) there are statistically significant differences in motor characteristics tests in individual test items.

We assumed that the results in the motor characteristics of the children from our research (File: R 2019) would be better than the results of the Roma children from the research (Horváth: R 2001). This hypothesis was confirmed, but not for all test items, not for all age categories of boys and girls. The assumption that the results of Romani children from our research (File: R 2019) would be better in tests of motor characteristics than the results of Romani children from research (Horváth: R 2001) was not confirmed for all test items. This assumption was clearly confirmed in the LS, VZH and CBEH test items, in the VBEH and SKOK items, where the results were ambiguous depending on the age categories and gender of the children. In the PRKL item, both boys and girls had better results in all age categories from the research (Horváth: R 2001).

However, it is important to point out that when evaluating the results of Roma children, we must take into account the specifics of the life of this ethnic group. The increase in body weight and BMI, which we evaluated negatively in children of the majority population, must be evaluated differently in the case of Roma children. In research (Horváth: R 2001) it was stated that Roma children lag behind children of the majority population by 2-3 years in somatic characteristics. Roma children were on the borderline of malnutrition when analyzing BMI. This has changed in our research (File: R 2019) and Roma children are in the 40th percentile of BMI, which is positive news. Apparently, this testifies to the higher standard of living of some Roma families. According to the atlas of Roma communities, Roma in Slovakia live in cities, on the outskirts of towns and villages, and in settlements outside villages. The results of our research (File: R 2019) also depend on the percentage of children from each environment that made up the sample we examined.

When evaluating the motor characteristics of Roma children, we note that the results of Roma children in our research (File: R 2019) show better results than the research (Horváth: R 2001), although not statistically significant for all items. When analyzing these results, we assume a certain correlation between improved somatic characteristics and motor characteristics. Here, however, it is important to point out that the results of Roma children depend on the composition of the compared

groups (Roma children from cities, villages and Roma children from marginalized communities in settlements) and with an unequal percentage composition of the compared groups, the results can be significantly distorted.

When evaluating the movement activities of Roma children, it is also necessary to be aware that they are mostly dependent on natural movement in nature. Two hours of physical education at school, often without a gym only in the corridors, cannot be enough for the healthy development of children. Only for some Roma children living in cities can have sports clubs at school.

Approximately 45,000 Roma live in Slovakia, most of them in eastern Slovakia. If in the majority society there are 12% of children, in the Roma population it is 46% of children. The purpose of our work is to contribute to the updating and expansion of existing empirical and scientific knowledge about basic socio-bio-physiological characteristics and differences in the development of Roma children of younger school age. This is an issue that significantly affects a wide range of current and future problems of members of marginalized Roma communities (we mean the interrelationship between health status, socio-economic situation, school success and, consequently, applicability on the labor market, etc.). The aim of the work was to determine the current state of somatic and motor characteristics of children of younger school age from Roma communities using anthropometric methods and the application of a modified EUROFIT-test. In order to determine the development trend of somatic and motor characteristics in Roma children, compare them with data from 20 years ago, which was processed by the author Horváth (2001). Similar research has not yet been carried out in Slovakia in a long-term perspective.

4 Conclusion

In our contribution, we tried to approach the issue of motor performance of Roma children of younger school age by following trends in the development of somatic and motor characteristics over a 20-year period. To determine the level of motor skills, we used selected tests from the EUROFIT battery. We compared the achieved research results of all Roma children with the research results (Horváth: R 2001). By analyzing and comparing the results, we point out development trends after a 20-year period and at the same time provide an analysis of the causes of possible changes.

(668) Roma primary school children from five towns in the East Slovak Region participated in our research. The aim of the paper was to identify the current state and level of somatic and motor characteristics of children in primary education in primary schools in the East Slovak region in two selected groups: research (Horváth: R 2001), which carried out research on a sample of (1093) children, and our research (File: R 2019), implemented on a sample of (668) Roma children - in relation to age and gender.

Based on the obtained results, we noted a statistically significant increase in somatic characteristics, especially weight, in our research (File: R 2019) among Roma children of younger school age compared to the research (Horváth: R 2001). For Roma children of younger school age, however, we consider this as positive, since the Roma children from the research (Horváth: R 2001) were at the border of malnutrition in that period and lagged behind children of the same age category and gender of the majority society by up to 2 years.

In most of the motor characteristics of the Roma children from our research (File: R 2019), we recorded better results than the children from the research (Horváth: R 2001), although not always statistically significant. We also assume that the improvement of motor characteristics is correlated with better somatic characteristics. However, it is important to point out that the results of Roma children depend on the composition of the compared groups (Roma children from cities, villages and Roma children from marginalized communities in settlements) and

with an unequal percentage composition of the compared groups, the results can be significantly distorted.

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MILITARY EXPENDITURE AND UNEMPLOYMENT IN SELECTED NATO MEMBER STATES

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Abstract: The paper is concerned with the relationship between military expenditure and unemployment. The purpose of the paper is to discover the relationship between military expenditure and the unemployment rate using NATO economies as examples and to analyse possible stabilizing effects of military expenditure by means of the ARDL model. The empirical results reveal a negative correlation between military expenditure and the unemployment rate indicating possible important influence of the armed forces as an employer on the labour market in Albania, Bulgaria, Poland and Romania. However, the model results do not confirm that military expenditure could have a stabilizing effect on the state economic policy across NATO member states.

Keywords: military expenditure, labour market, unemployment, personnel economics, ARDL model.

1 Introduction

Unemployment as a sign of imbalance in the labour market is one of crucial issues having an impact on pursuing the economic policy of the state consisting in accomplishing economic objectives of the government. The government through its fiscal policy uses government spending to stimulate the economic growth which has a positive effect on the demand in the labour market and, therefore, unemployment decrease as one of the objectives of the government economic policy. Military expenditure is a substantial part of government spending and forms almost 10 per cent of government spending in the USA and several per cent in the European NATO member states depending on trends in security and economic determinants of military expenditure.

According to the (SIPRI) definition, military expenditure can be understood as total personnel expenditure payable to military and civil personnel, pensions and retirement pays regularly paid to retired soldiers and reservists, expenses connected with social welfare services for the employees and their family members, operating expenses and expenses relating to maintenance, purchase of military equipment, material and services, military construction, military aid, and conducted military research. According to the structure military expenditure can be classified into three groups, namely mandatory spending, current expenditure, and capital expenditure. According to (Kollias et al., 2004) military expenditure as part of government spending can influence the economy among other things through the multiplication effect of government spending during periods when the economy is under the so called potential product. Military Keynesian economics as an economic policy type applied e.g. in Germany in the first half of the 20th century or in the USA at the end of the 20th century represented extensive use of military expenditure to stimulate economic growth and employment. (Garrett-Pollin and Pollin, 2007) describe economic impacts of military expenditure using the USA as an example where thanks to the multiplication effect 8,000 job positions were created as a result of 1 billion of military expenditure. On the other hand, the authors simultaneously demonstrate that 1 billion of government spending in health service, education or transportation, where the multiplication effect is higher in comparison with military expenditure, leads to the creation of a higher number of new job positions in the labour market. (Dunne and Nikolaidou, 2001) simultaneously emphasize that an increase in military expenditure as a possible stimulus to the economy is often accompanied by an increase in taxes, and state budget deficit increase, which can be seen in countries facing public finance deficits experiencing intense pressure on military expenditure reduction especially during the

economic crisis; the same trend can be observed in the NATO member states where only a small group of member states meets the requirement for the recommended 2 per cent of military expenditure as GDP percentage. According to (Sanso-Navarro and Cabello, 2015) and similarly according to (Tang et al., 2009) several channels can be observed through which military expenditure can influence supply and demand in the labour market and, therefore, the economic development of a country. Firstly, military expenditure can have a positive effect on labour demand through productivity-improving effects where investments as a component part of military expenditure, if invested in domestic economy, e.g. in the arms industry, naturally increase demand in the labour market. The mandatory part of military expenditure consisting primarily of personnel expenditure has a positive effect on the economic development through the consumption of products and services in the economy. The reallocation effect can have a similar effect in the labour market as it generates frictional unemployment and has an effect on labour supply in individual sectors influenced by military expenditure. Supply and demand in the labour market is further influenced by the tax-distortion effect meaning that military expenditure is financed through the tax system where a possible increase in the tax burden brought about by an increase in military expenditure has an effect on both supply and demand in the labour market.

The purpose of this paper is to explore the relationship between military expenditure and the unemployment rate and to analyse stabilizing (countercyclical) effects of military expenditure by means of the ARDL model.

2 Literature Overview

The analysis of the relationship between military expenditure and selected economic variables is the subject-matter of many economic studies exploring e.g. the analysis of the relation between military expenditure and economic growth (Dunne and Nikolaidou, 2001; Kollias et al., 2004), the analysis of economic determinants of military expenditure (Odehnal and Neubauer, 2020) and also the analysis of the relation between military expenditure and unemployment (Bäckström, 2019; Holcner et al., 2021; Smith, 1977) and shows a positive correlation between military expenditure (share of GDP) and the unemployment rate on the example of eight economies. The authors (Dunne and Smith, 1990) use the Granger causality test to analyse the relation between military expenditure and unemployment and its results fail to prove an effect of military expenditure on unemployment in the analysed OECD countries. The study results (Paul, 1996) confirm the conclusions concerning an ambiguous relation between military expenditure and unemployment on the example of OECD countries where, according to the author, uniform results relating to the analysed economies cannot be expected. In Germany and Australia military expenditure has a positive effect on the unemployment rate while in Denmark military expenditure has a rather negative effect on the labour market. The author fails to prove any significant relation between the analysed economic variables in the USA, Canada, Sweden, New Zealand, Austria, Spain, Italy, the Netherlands and Japan. (Tang et al., 2009) apply the Granger causality test to analyse 46 developing and developed countries from 1988 to 2004. The study results prove a significant relation between military expenditure and the unemployment rate on condition that military expenditure measured as share of GDP and only in developing countries having low GDP. As for OECD countries, the results (Dunne and Smith, 1990) confirm independent analysed variables. The research of the development of military expenditure and the unemployment rate in France from 1975 to 2008 is the subject-matter of the paper (Malizard, 2014). The ARDL model results analysing the unemployment rate, economic growth rate, share of military expenditure of GDP, and share of non-military expenditure of GDP reveal that as for France an increase in military expenditure results in rising unemployment; the author considers a practical implication of

this result where decreased military expenditure could have a positive effect on the unemployment rate. The author reveals a similar correlation between non-defence spending and unemployment; however, its adverse effect is less dramatic than that of military expenditure. The authors (Sanso-Navarro and Cabello, 2015) examine the correlation between military expenditure and unemployment in 15 EU states. The results of the Granger causality test reveal a very low correlation between military expenditure and unemployment where the authors admit that the use of military expenditure as an instrument of stabilization policy in relation to the rising unemployment rate in a country is very limited. Nevertheless, they simultaneously present Austria as an example where the highest correlation can be observed and they admit a possible effect of compulsory military service on the analysed relation in this country. Similar results confirming an increase in the unemployment rate if military expenditure rises are obvious from an analysis of selected 10 Central European countries. On the basis of panel data analysis results the authors (Korkmaz, 2015) confirm the results achieved by the authors (Sanso-Navarro and Cabello, 2015) and they consider government spending invested in education and the infrastructure to be more growth initiating spending. The study (Khan et al., 2015) analysing the relationship on the example of selected Asian countries (Cambodia, China, Malaysia, Pakistan) arrives at similar conclusions. Empirical results confirm that the effect of government spending invested in other industries is by far more positive on the economy of analysed countries than military expenditure.

The conclusions of the above authors are verified in the below text by means of the ARDL model (Gökçeli et al., 2022, Tolasa et al., 2022) where the authors analyse the correlation between military expenditure and the unemployment rate using NATO member states from 1999 to 2020 as an example.

3 Data

To analyse the relation between military expenditure and unemployment, data characterizing military expenditure of the NATO member states (military expenditure per capita) and the unemployment rate indicator are used. Data describing military expenditure is acquired from the SIPRI database and data characterizing the unemployment rate development from the WDI database published by the World Bank.

Data characterizing the unemployment rate in 29 NATO member states from 1999 to 2020 describe the lowest unemployment rate at the beginning of the analysed period primarily in the "traditional" NATO member states, where the unemployment rate in Luxembourg was only 2.3%, in Norway 3.2%, in the Netherlands 3.6%, in Denmark 3.1%, in Portugal 4.6%, in the United Kingdom 6%, and in Belgium 8.6%. On the other hand, the highest unemployment rate at the end of the 1990s was reported in France 11.9% and in Italy 11.6%. In 2005 the unemployment rate in Germany was high too, namely 11%. The unemployment rate in North America was 4.2% in the USA and 7.5% in Canada. The analysed traditional member states did not experience any wide fluctuations in the unemployment rate during the following years; more considerable fluctuations occurred as late as 2008 in consequence of the economic crisis faced by the majority of NATO members. The highest increase in the unemployment rate was recorded in Greece and Spain where the unemployment rates in 2013 were 27.4% and 26% respectively. The causes of high unemployment in Greece lay in economic problems of the country connected with the debt crisis and cost-saving measures imposed by the Greek government.

As far as the new member states are concerned (accession at the beginning of the analysed period), the lowest unemployment rate of 6.9% was recorded in Hungary in 1999. The Czech Republic was faced with unemployment of 8.4% and Poland 12.2%. During the economic crisis the unemployment rate increased by 2 per cent on average in the Czech Republic and Hungary. The highest unemployment rate of 19.8% was recorded in Poland in 2002. Constantly falling investments and public finance

imbalance were persistent problems in Polish economy. In 2004 new member states acceded to the NATO, out of the former Warsaw Pact the Alliance was joined by Bulgaria, Estonia, Lithuania, Latvia, Romania, and Slovakia. In 2009 the new member states were Albania and Croatia. In 1999 before joining the Alliance the lowest unemployment rate of 6.3% was measured in Romania, followed by Slovenia 7.3%, Estonia 11.5%, Lithuania 13.3%, Croatia 13.5%, Latvia 13.7%, Bulgaria 14.1%, Slovakia 15.9% and Albania 16.6%. The economic crisis had a similar impact on both the traditional and new NATO member states where the unemployment rate increased in the majority of them in 2010: Slovakia 14.3%, Estonia 16.7%, Lithuania 17.8% and Latvia 19.4%. The consequences of the economic crisis became apparent in Croatia and Albania as late as 2015 when the unemployment rates grew to 17.2% and 17.4% respectively. In the last analysed year 2020 the unemployment rate stabilized at 3.8% in Slovenia, Bulgaria and Romania. These countries were followed by Slovakia, Croatia, Estonia, Lithuania, and Latvia where the unemployment rates varied from 5 – 7%. The unemployment rate in Albania was 12.8%. The last two countries that joined NATO were Montenegro in 2017 and North Macedonia in 2020. The unemployment rates measured in these countries before joining were high: more than 30% in 1999. In 2020 the unemployment rates measured in Montenegro and North Macedonia were 14.7% and 16.4% respectively.

Data characterizing military expenditure development (per capita) has been acquired from the SIPRI database. At the beginning of the analysed period, in 1999, military expenditure increased in many countries following a long period of reductions in military expenditure. The USA and France experienced the biggest increase. In 1999 the USA incurred military expenditure (per capita) of the United States dollar (hereinafter abbreviated as USD) 1070.2, Norway USD 739.6, the United Kingdom USD 694.2, and France USD 556.6. On the other hand, Central European countries which were not members of NATO yet incurred the lowest military expenditure (Albania, Lithuania, Latvia, Bulgaria and North Macedonia).

Per capita military expenditure grew in almost all analysed countries from 1999–2004. On the other hand, Belgium reduced military expenditure from USD 350.9 per capita in 1999 to USD 303.6 in 2002 but increased the expenditure significantly to USD 372 per capita in 2003. Military expenditure grew in North Macedonia in 2000 and 2001. In 2000 North Macedonia spent USD 34.3 per capita and in the following year USD 110.8 per capita. It was caused by an armed conflict between the government of North Macedonia and Albanian rebels in 2000–2001 which brought the country to the edge of civil war. Per capita military expenditure went down from USD 158 to USD 112.4 in Turkey in 2001.

In 2004 average world military expenditure corresponded to USD 162.0 per capita and 2.6% of Gross World Product or global GDP. Military expenditure in the USA increased in consequence of massive expenditure on the Global War on Terror, primarily military operations in Afghanistan and Iraq from 2002–2004. The USA spent USD 1686.3 per capita on military purposes, Norway USD 1062.9, the United Kingdom USD 1006.3, France USD 733.5, and Denmark USD 662.4 per capita followed by Greece, the Netherlands, Germany, Italy and Luxembourg. In 2004 seven countries joined NATO. The new members failed to achieve the world average with the exception of Slovenia with USD 247.8 per capita. Bulgaria had per capita military expenditure of USD 80.2, Estonia USD 150.3, Latvia USD 100.6, Lithuania USD 80.1, Romania USD 70.9, Slovakia USD 131.7, and Slovenia USD 247.8. In 2004 Albania had the lowest per capita military expenditure of USD 32.5 a North Macedonia USD 65.8; however, these countries were not NATO members in the given year.

In 2005 the majority of countries reduced military expenditure with the exception of the USA where military expenditure increased from USD 2164 in 2004 to USD 2304 in 2005. That year also saw an increase in per capita military expenditure in Portugal from USD 454.2 to USD 466.8, in Greece from USD

957.8 to USD 971.0, and France from USD 890.0 to USD 902.4. This situation developed in reaction to the economic crisis experienced by the Allies.

The global economic crisis had only a minimal impact on global military spending in 2009. The majority of advanced economies maintained or increased the military expenditure level, the USA increased military expenditure to USD 2304.6 per capita. France maintained the level of USD 902.4 and so did Greece with USD 971.0. All the other analysed countries showed a reduction. The United Kingdom demonstrated a reduction from USD 1173.3 in 2008 to USD 1018.8 in 2009. The new member states joining NATO in 2009 announced reductions in per capita military expenditure, namely Albania from USD 85.1 in 2008 to USD 61.5 in 2009, and Croatia from USD 297.7 in 2008 to USD 260.1 in 2009.

Global military spending did not rise in 2011, for the first time from 1998, primarily due to economic policies adopted in the majority of western countries in consequence of the global economic crisis. Governments in Western and Central European countries imposed austerity measures including cuts in military spending. Greece, Italy and Spain were unable to discharge their debt obligations and in exceptional cases even required financial support from the European Union and the International Monetary Fund. Out of these three countries Greece recorded the biggest fall, it had per capita military expenditure of USD 971.0 in 2009, USD 749.8 in 2010, and USD 658.3 in 2011.

Military expenditure of the USA went down for the first time in 2012. In 2011 it amounted to USD 2414.4, and in 2012 it fell to USD 2309.2. Military spending in the USA actually fell by 5.6%. It was a period of stagnation or rather reduction in military expenditure in all analysed countries.

The US military spending showed a downward trend up to 2015; in 2015 it amounted to USD 1975.3 and stagnated for the two following years. It was a consequence of the withdrawal of the US armed forces from Iraq at the end of 2011 and the effect of the Budget Control Act of 2011.

In 2016 the US military spending increased and it was the first year-on-year increase from 2010, per capita military expenditure amounted to USD 1980.9 in 2016.

In 2017 military expenditure in Western Europe increased and this trend continued in these countries in the subsequent analysed period. One of the reasons was the NATO Wales Summit 2014. The majority of analysed countries showed a modest increase in military expenditure from 2017–2020; in 2020 it was connected with the Covid–19 pandemic. Hungary increased its military spending as part of fiscal stimuli in reaction to the pandemic in 2020. It led to an increase in military expenditure. In 2019 Hungary incurred per capita military expenditure of USD 211.8, and in 2020 USD 249.4.

The relationship between military expenditure and the unemployment rate in selected NATO economies is analysed using the ARDL model in the below sections.

4 Models and Methods

For econometric modeling purposes, we first use panel data models, subsequently we apply ARDL models for individual states. The general panel model can be written in the form

$$y_{it} = \alpha_i + \beta'X_{it} + u_{it}, \quad (1)$$

where $i = 1, 2, \dots, n$ is the individual index (for example group, country, ...), $t = 1, 2, \dots, T$ is the time index and u_{it} is a random zero mean error term, X_{it} is a $k \times 1$ vector of explanatory variables, β_{it} is a $k \times 1$ vector of unknown parameters. The parameters β_{it} are not estimable with $N = n \times T$ data points, therefore, a number of assumptions is usually made about the parameters, the errors and the exogeneity of regressors. Firstly,

let us assume that $\alpha_{it} = \alpha$ for all i, t and $\beta_{it} = \beta$ for all i, t . We get the model

$$y_{it} = \alpha + \beta'X_{it} + u_{it}, \quad (2)$$

which is a standard linear model *pooling* all data across i and t , it can be estimated by the ordinary least squares (OLS) method. To model individual heterogeneity, let us assume that the error term has two separate components $u_{it} = \mu_i + \varepsilon_{it}$, where μ_i is specific to the individual and does not change over time

$$y_{it} = \alpha + \beta'X_{it} + \mu_i + \varepsilon_{it}. \quad (3)$$

The error term ε_{it} is usually assumed independent of both the regressors X_{it} and the individual component μ_i . If the individual component is correlated with the regressors, it usually treats the μ_i as next n parameters to be estimated. This is called the *fixed effect* model (Hsiao 2014; Wooldridge 2002). If we denote $\alpha_i = \alpha + \mu_i$ we obtain the model

$$y_{it} = \alpha_i + \beta'X_{it} + \varepsilon_{it}. \quad (4)$$

This model is usually estimated by OLS. If the individual component μ_i is uncorrelated with the regressors, the model is termed *random effect*, μ_i are not treated as fixed parameters, but as random drawings from a given probability distribution. One of the assumptions related to OLS is that the error term is independently and identically distributed. In the context of panel data it means that $E(u_{it}^2)$ equals a constant σ_u^2 for all i and t , the covariance $E(u_{is}, u_{it})$ is equal to zero for all $s \neq t$ and the covariance $E(u_{jt}, u_{it})$ equals zero for all $j \neq i$. If these assumptions are not met, and they are unlikely to be met in case of panel data, OLS estimator is not the most efficient estimator. To get greater efficiency, the generalized least squares (GLS) method, taking into account the covariance structure of error term, may be used.

A dynamic linear panel data model can be written in the form

$$y_{it} = \rho y_{i,t-1} + \beta'X_{it} + \mu_i + \varepsilon_{it}. \quad (5)$$

The model is first differenced to get rid of the individual effect. First differencing (5) yields

$$\Delta y_{it} = \rho \Delta y_{i,t-1} + \beta' \Delta X_{it} + \Delta \varepsilon_{it}. \quad (6)$$

The error term $\Delta \varepsilon_{it}$ is autocorrelated and also correlated with lagged dependent variable $\Delta y_{i,t-1}$. A generalized method of moments approach is used to get estimates of equation (6), see (Arellano and Bond, 1991).

To model individual countries we apply the autoregressive distributed lag model ARDL(p, q_1, q_2, \dots, q_k), where p is the number of lags of the dependent variable Y_t , q_1, q_2, \dots, q_k are numbers of lags of explanatory variables X_{it} , $i = 1, 2, \dots, k$. The model can be written in the form

$$Y_t = \alpha + \sum_{i=1}^p \gamma_i Y_{t-i} + \sum_{j=1}^k \sum_{i=0}^{q_j} \beta_{j,i} X_{j,t-i} + \varepsilon_t,$$

where ε_t is a one-dimensional zero mean error term. The lag lengths in the model can be determined by the standard information criterion such as Akaike, Schwarz or Hannan-Quinn information criterion (see for example Baltagi, 2011).

5 Results

The purpose of statistical analysis is to identify the relation between military expenditure and unemployment. We use the below denotations in the following models:

Milex	logarithm of military expenditure per capita
Unempl	logarithm of unemployment rate

Data about 29 selected NATO member states from 1999–2020 are analysed. First, we calculate tests of individual roots for the given panel, see Table 1. Total 4 tests are used (see for example Hsiao, 2014) and it arises from their results that the analysed time series can be considered stationary at a 0.05 level of significance.

Tab. 1: Panel unit roots

	Levin, Lin & Chu	Im, Pesharan and Shin	ADF-Fisher	Maddala-Wu
Unempl	0.0357	0.0024	0	0
Milex	0	0.0038	0.0051	0

Source: <https://milex.sipri.org/sipri>, <https://databank.worldbank.org/source/world-development-indicators#>, authors' calculation.

We also analyse possible causal relationship between variables. The Dumitrescu Hurlin Panel Causality Test (Dumitrescu and Hurlin, 2012) is carried out for lag 1 and 2, see Table 2. As for lag 1, it can be stated that there is a mutual causal relationship between the variables, and as for lag 2, it can be stated that there is only one-way causal relationship when military expenditure has a causal influence on unemployment in Granger's sense.

Tab. 2: Granger causality test

	lag 1	lag 2
Unempl does not homogeneously cause Milex	0	0.0024
Milex does not homogeneously cause Unempl	0	0.7009

Source: <https://milex.sipri.org/sipri>, <https://databank.worldbank.org/source/world-development-indicators#>, authors' calculation.

To perform a detailed analysis of the identified relationship the fixed effect model (Table 3) and the GMM dynamic panel (Table 4) are used. In both models delayed values of the Unempl variable and values of the Milex variable are selected as regressors. In the fixed effect model an autocorrelation analysis of residues is performed and it can be stated that the residues are not correlated (p-value of Breusch-Godfrey/Wooldridge test for lag 1 is 0.09411, for lag 2 is 0.1665; Durbin-Watson test p-value is 0.1617, Wooldridge's test p-value is 0.1772). The autocorrelation structure of residues in the GMM model also complies with the model assumption (Arellano-Bond test AR(1) p-value is 0.00018, AR(2) p-value is 0.42219). The results of the

fixed effect model confirm a negative relationship between the analysed variables in the group of NATO member states where the increased military expenditure algorithm (military expenditure per capita) causes a decrease in the unemployment rate by 0.05%. A similar conclusion can be reached in the GMM dynamic model where an increase in the military expenditure algorithm causes a decrease in the unemployment rate by 0.089%.

Tab. 3: Panel data – fixed effect model

Coefficients	Estimate	Std. Error	t-value	p-value
const	0.709	0.130	5.444	0.00000
Unempl _{t-1}	1.347	0.036	37.638	0.00000
Unempl _{t-2}	-0.551	0.037	-14.855	0.00000
Milex _t	-0.050	0.019	-2.642	0.00847

Source: <https://milex.sipri.org/sipri>, <https://databank.worldbank.org/source/world-development-indicators#>, authors' calculation.

Tab. 4: Panel data – dynamic GMM model

Coefficients	Estimate	Std. Error	z-value	p-value
Unempl _{t-1}	1.314	0.069	18.992	0.00000
Unempl _{t-2}	-0.559	0.059	-9.524	0.00000
Milex _t	-0.089	0.031	-2.821	0.00479

Source: <https://milex.sipri.org/sipri>, <https://databank.worldbank.org/source/world-development-indicators#>, authors' calculation.

We use the ARDL model to perform a detailed analysis of the relationship between military expenditure and the unemployment rate enabling us to analyse the results for every of the NATO member states which are part of the research. The results identify a statistically significant relationship confirming the anticipated relationship concerning Albania, Bulgaria, Poland and Romania (0.05 level of significance). It can also be found in Germany at 0.10 level of significance.

The estimated parameter is negative for states like Belgium, Canada, Croatia, Estonia, Latvia, Lithuania, Luxembourg, North Macedonia, Norway, Romania, and Slovakia; however, it is statistically insignificant. The estimated parameter is positive for the remaining countries; however, the estimates are not statistically significant.

Tab. 5: ARDL model

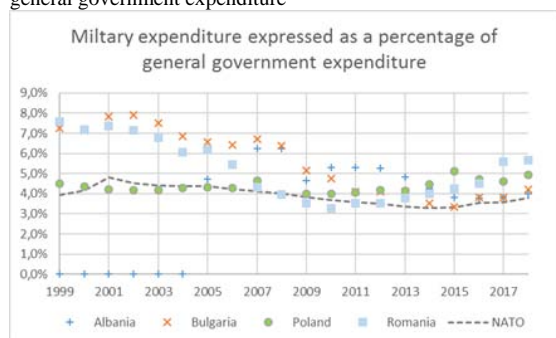
	Coefficients				p-values				R ²
	const	Unempl _{t-1}	Unempl _{t-2}	Milex _t	const	Unempl _{t-1}	Unempl _{t-2}	Milex _t	
Albania	2.005	0.975	-0.580	-0.095	0.00433	0.00022	0.01529	0.03572	0.757
Belgium	1.046	1.028	-0.443	-0.035	0.21762	0.00012	0.06635	0.77854	0.631
Bulgaria	2.509	1.295	-0.718	-0.339	0.01184	0.00000	0.00047	0.02309	0.936
Canada	1.450	0.940	-0.372	-0.100	0.06083	0.00083	0.16243	0.19502	0.601
Croatia	1.062	1.614	-0.940	-0.046	0.20914	0.00000	0.00001	0.70305	0.938
Czech Republic	-0.659	1.389	-0.402	0.118	0.59659	0.00002	0.17643	0.56290	0.898
Denmark	0.236	1.039	-0.386	0.053	0.86957	0.00035	0.11072	0.80612	0.650
Estonia	1.958	1.033	-0.585	-0.145	0.04143	0.00014	0.01007	0.20335	0.724
France	0.089	0.825	-0.152	0.094	0.94137	0.00304	0.54391	0.49661	0.511
Germany	1.387	1.423	-0.479	-0.211	0.07800	0.00000	0.04416	0.07702	0.976
Greece	-0.386	1.724	-0.807	0.096	0.60653	0.00000	0.00003	0.35245	0.966
Hungary	-0.226	1.612	-0.700	0.078	0.77601	0.00000	0.00645	0.55913	0.927

Italy	-0.288	1.396	-0.507	0.087	0.87782	0.00000	0.04544	0.72547	0.862
Latvia	2.387	1.038	-0.667	-0.178	0.01316	0.00015	0.00313	0.08588	0.781
Lithuania	1.993	1.158	-0.703	-0.156	0.01251	0.00001	0.00062	0.10310	0.832
Luxembourg	0.525	0.843	-0.071	-0.023	0.72855	0.00381	0.75829	0.93057	0.737
Montenegro	0.587	1.206	-0.415	0.001	0.54249	0.00045	0.08809	0.99376	0.866
Netherlands	0.306	1.424	-0.730	0.025	0.77753	0.00000	0.00021	0.88568	0.882
North Macedonia	-0.118	1.395	-0.287	-0.066	0.73692	0.00002	0.34464	0.26554	0.964
Norway	1.709	1.066	-0.593	-0.147	0.07417	0.00005	0.00575	0.23447	0.721
Poland	1.816	1.347	-0.545	-0.265	0.04177	0.00000	0.00611	0.04781	0.970
Portugal	0.036	1.407	-0.578	0.057	0.96924	0.00000	0.00376	0.74481	0.926
Romania	1.240	0.441	0.332	-0.180	0.04836	0.08802	0.19171	0.01329	0.842
Slovakia	0.171	1.441	-0.505	-0.009	0.87359	0.00003	0.05513	0.94739	0.920
Slovenia	0.449	1.464	-0.724	0.005	0.62696	0.00000	0.00677	0.96666	0.831
Spain	-1.169	1.348	-0.486	0.262	0.38017	0.00001	0.03854	0.22174	0.893
Turkey	1.340	0.780	-0.472	0.050	0.04204	0.00078	0.04226	0.71739	0.533
UK	-1.235	1.183	-0.384	0.230	0.33643	0.00024	0.14995	0.23154	0.855
USA	0.329	1.436	-0.712	0.020	0.77015	0.00000	0.00154	0.89859	0.857

Source: <https://milex.sipri.org/sipri>, <https://databank.worldbank.org/source/world-development-indicators#>, authors' calculation.

The ARDL model results do not confirm the stabilizing effect of military expenditure in the NATO member states where military expenditure has a positive effect on the unemployment rate demonstrated in the form of a decrease in the rate in a small group of the new member states. It is also not possible to consider the results uniform within the Alliance and no general conclusion can be reached that an increase in military expenditure causes a decrease in unemployment. A closer analysis of Albania, Bulgaria, Poland and Romania indicates that military expenditure as part of the prioritization of the army (measured as a share of military expenditure of government spending) in these countries is above-average in the current form of the Alliance, see Figure 1. Figure 1 illustrates that the highest share of military expenditure of government spending can be seen in Bulgaria and Romania in the first half of the analysed period and in Poland in the latter half of the period.

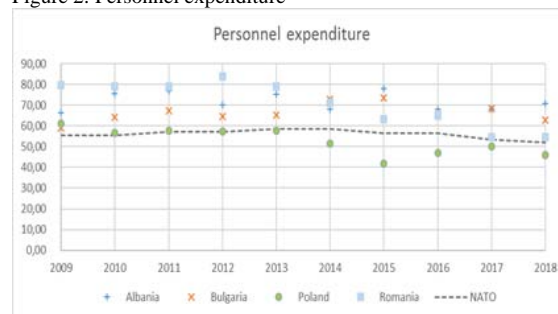
Figure 1: Military expenditure expressed as a percentage of general government expenditure



Source: <https://milex.sipri.org/sipri>, adjusted by the authors.

Figure 2 shows that in countries where the reducing effect of military expenditure on unemployment has been detected, more than 60% of military expenditure arises primarily from personnel expenditure for almost the entire analysed period, provided that military expenditure is classified into mandatory spending (personnel expenditure), current expenses, and investment. The only exception is Poland where the recommended military expenditure structure has been followed since the NATO Wales Summit.

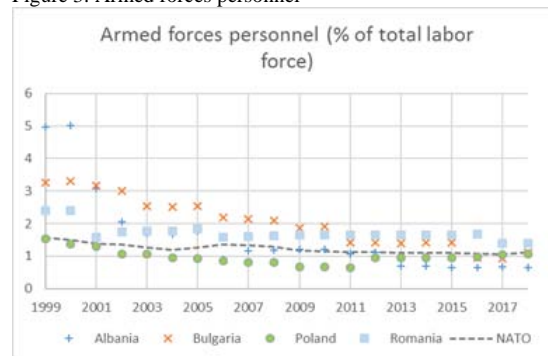
Figure 2: Personnel expenditure



Source: <https://milex.sipri.org/sipri>, adjusted by the authors.

Figure 3 shows that the share of armed forces personnel of total labour force compared with the Alliance average is above-average in the 4 analysed countries (with the exception of Poland and Albania starting from 2013), which demonstrates the position of the armed forces as an employer in the labour market. A higher share of the military personnel can be seen especially in Bulgaria and Romania if compared with the NATO average. The armed forces as an employer in the labour market employ a higher share of people in comparison with the NATO average in countries where a relationship between military expenditure and the unemployment rate has been discovered.

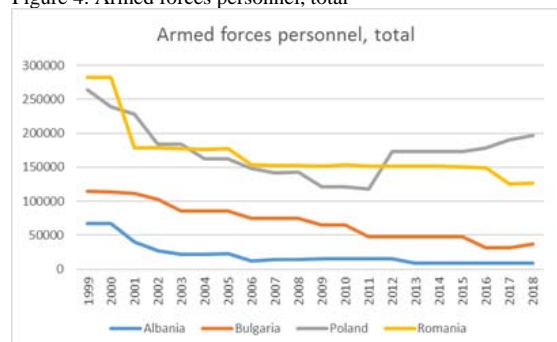
Figure 3: Armed forces personnel



Source: <https://databank.worldbank.org/source/world-development-indicators#>, adjusted by the authors.

Figure 4 shows the development in the number of personnel in the 4 analysed NATO member states. Figure 4 shows a significant reduction in the personnel especially at the beginning of the analysed period. The development was influenced by the transition to a professional army in the majority of countries. An increase in the number of personnel in Poland can be clearly seen from 2014 in connection with the policy of Russia.

Figure 4: Armed forces personnel, total



Source: <https://databank.worldbank.org/source/world-development-indicators#>, adjusted by the authors.

The analysis of the development of selected indicators characterizing military expenditure, its structure, and selected labour market indicators shows possible causes of the relationship between military expenditure and the unemployment rate in Albania, Bulgaria, Poland and Romania. It primarily concerns the position of the armed forces as an employer in the labour market because the share of armed forces personnel is higher in the analysed countries in comparison with the NATO average. It also shows the structure of military expenditure in this group of countries where the majority of military expenditure is represented by mandatory spending, i.e. expenses covering salaries of soldiers, which is one of the factors making armed forces attractive as an employer in the labour market. The share of employed military personnel of the total labour force, however, is only one of the channels through which military expenditure can influence unemployment in individual regions and entire countries. The economic consequences of military expenditure in the form of a multiplication effect and its effect on the economic development of a country, e.g. in the form of investments and, therefore, also acquisitions of military hardware and equipment or conducted research significantly stimulate employment in domestic armaments industry.

6 Discussion and Conclusion

The relationship between military spending and unemployment is a controversial aspect of the National Defence Economy. This relationship has been examined by many authors but the studies have not indicated any uniformity in empirical results. Previous publications have investigated the economic relations between military recruitment and its effect on the labour market in the Czech Republic (Holcner et al., 2021). The results have not confirmed that a higher share of military expenditure of GDP has a positive effect on army recruitment and a higher number of new employees in armed forces. A hypothesis suggesting that a higher unemployment rate has a positive effect on army recruitment and a higher number of recruited soldiers has also been rejected. The publication (Bäckströma, 2019) explored the relationship between the conditions in the civil labour market and the labour force offer in the Swedish army.

To identify possible relations between the two aforementioned variables in selected NATO member states, the authors have used the ARDL model. The time series relating to the time period from 1999 – 2020 has been selected in the SIPRI and World Bank databases. The empirical results have indicated a negative correlation between economic growth and military expenditure in 4 countries (Albania, Bulgaria, Poland, and Romania). The results, therefore, have not confirmed agreement among the NATO member states and provide only limited

support for the idea about military expenditure having a positive effect on unemployment reduction and a stabilizing effect on the economy. The results have not confirmed the idea about a reduction in military expenditure leading to a reduction in unemployment due to a reallocation of public spending to other industries which can be considered industries having a more positive effect on the employment in the country in view of the situation in the labour market. The economy of every country has a whole range of determinants influencing the unemployment rate. The purpose of this article was to analyse one of these factors, namely military expenditure as part of government spending. Despite the aforementioned, military expenditure also has a positive effect on the economy which should be examined and analysed, e.g. the multiplication effect of military expenditure and its macroeconomic consequences, or the effect of military expenditure on regional labour markets.

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Primary Paper Section: A

Secondary Paper Section: AH, KA, BB

TRANSFORMATIVE EDUCATION WITH AGILE PROJECT MANAGEMENT AND PROJECT-BASED LEARNING

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Abstract: The present trend of automation and digitization of jobs has made the skills gap even more pronounced, indicating that graduates are not sufficiently prepared for the challenges they will face in their careers. The educational process needs to adapt quickly to the demands made by employers and the job market. Learning tasks, assignments, and activities should mimic the practice environment as far as possible, to best prepare students for practice. One of the best approaches appears to be the incorporation of agile project management techniques and project-based learning into the educational process. The primary aim of this research is to examine the effects of implementing agile management techniques and project-based learning into education on students' skill sets and performance improvement rates. The activities and results that the students produced throughout the semester were gathered and assessed over two academic years. The course feedback was also gathered to investigate students' opinions about the course and their involvement during the semester. An exploratory study was conducted in order to achieve the results. The influence of implemented innovations on the course was addressed, and the acquired outcomes were contrasted and appraised.

Keywords: education innovation, agile techniques, SCRUM, project-based learning, skills gap, higher education

1 Introduction

Changes in the world, in human society and the world of technology, are also creating a need for change in education. Due to constant geopolitical and climatic changes, it is therefore important that educational activities meet the challenges for achieving Education for Sustainable Development (UNESCO, 2020) to educate a young generation capable of responding to the above-mentioned changes in society and on Earth at all. The basic principle of survival will be cooperation therefore becomes important the introduction of how to solve various problems in different areas within a small team into the education process. One of the benefits is, that students could gain experience of how to do this in a safe (they do not have to worry about possible failure) and controlled, secure environment (where the teacher is always available in case of problems and guides them through a crisis and where they do not have to worry about the consequences of an incorrectly chosen solution, failure of the proposed solution, etc.) while they could develop their talents and skills. To help them the teacher has several tools and methods to achieve this objective, but most often used is project-based learning. Project-based learning provides a space for hard but also soft skills development of the students. By working in small groups communication and close collaboration, bringing individual talents together, solution-focus, sharing knowledge, positive attitude, respect, etc. is enhanced and trained (Mickan & Rodger, 2000). Commitment, focus, openness, respect, and courage are the core values of the SCRUM method (Scrum Guides, 2020) - agile project management - thanks to which it seems to be a suitable method for education.

This paper, therefore, presents how SCRUM is implemented in education at our educational institution. Our basic motivation was to implement an innovative method of team management into a course focusing on the area of business informatics. As we have already implemented the project-based learning method in the past in this course, where students worked on solving problems in micro-teams, we were interested in whether the implementation of the SCRUM method will bring the development of team skills in our course and whether these changes will be reflected in the overall assessment of students. In this paper, we present our method of implementation of project-based learning enriched by the SCRUM method and compare the results with the results from the previous year, when only the project-based learning method was implemented. Based on the review of the published research results and our implemented

innovation using PBL methods with SCRUM, we defined the following research questions: How will the introduction of PBL and SCRUM in the classroom affect students' outcomes? Will the introduction of these methods have an impact on the development of students' soft skills?

We tried to find answers to these questions by using and analyzing different data that can be collected during the course implementation and after the course completion. The comparison of the results obtained by us, as well as the results of other published works (Krajcik & Shin, 2014; Ralph, 2015; Torres, Shiraman & Ortiz, 2019), led us to describe the benefits, shortcomings as well and challenges for further innovations in education using the mentioned methods. Our main aim is not to generalize achieved results but to understand the cases better.

2 Literature review

Technology and automation are readily available, prompting employers to have different needs not only for the younger generation but also for the active workforce. It is expected, that by 2030, around 30-40% of the workforce in developed countries will require skills upgrading or complete skill set transformation (Hancock et al., 2020). The skill gap is growing and employers struggle with a shortage of suitable labor every year. The importance of soft skills and their scarcity is increasingly becoming evident. The incorporation of soft skills development into university education influences the employability of young people, the competitiveness of enterprises at the national and international level, which means the economic development of countries also in the global dimension (UNESCO, 2015).

Soft skills (a group of socio-psychological skills) enable successful integration and participation in the work process (e.g. analytical, predictive, and creative thinking, communication, the ability to cooperate and negotiate, the desire to acquire new knowledge and self-development, self-organization, skill lines, developed social and emotional intelligence etc.) (Panfilova & Larchenko, 2021).

Soft skills could be developed through formal, non-formal, and informal activities performed with various tools like mini-curricula; programs, workshops and labs; training sessions; projects (internal project works, external cooperation projects etc.); internal and external competitions; cycles of seminars (face to face lessons) and/or colloquia (guest speakers); company visits, journeys (study tours), internship and on the job training; individual or group tasks/learning based on practical activities. One of the important factors is to bring students together in a common but also competitive environment where they can learn from each other and through exposure to authentic, complex, and real-life problems.

Laboissiere and Mourshed (2017) listed the effective training components as programs engaging participants and delivering the exact skills required for each profession, curricula emphasizing practical tasks, regular testing and assessing during the course, and employing different ways of delivering necessary instructions to students. By using the two following described approaches (Project-based learning and Agile techniques) it is possible to improve the effectiveness of the educational process.

2.1 Project-based Learning

Project-based learning (PBL) is not a new method or approach in education. Already in 1974, it was implemented at Aalborg University, Denmark (Luxhøjsj and Hansen, 1996). Due to its many advantages, this method is often used at all levels of education, including primary and secondary schools, as well as universities (e.g. Affandi & Sukyadi, 2016; Costa-Silva et al., 2018; Mou, 2019). PBL Works (2022) defined Project-based

learning as a teaching method in which students gain knowledge and skills by working for an extended period to investigate and respond to an authentic, engaging, and complex question, problem, or challenge. What is important to mention, is the main principle is that the project is closely connected to the curriculum learned (PBLWorks, 2022).

Using the PBL teachers get the tool for reaching more engaged students because students see the meaning of course content and its usability in real-world problems or situations solution. Participating in the PBL students develop their hard but also soft skills (Condcliffe et al., 2017; Parker et al., 2013). There are known six 7 essential project design elements that need to be delivered: the level of challenge must be appropriate, the project must be concerned with meaningful and real-world problems, students are involved in posing questions, finding resources, applying information, students making decisions about the project and they can express their own ideas and voice, students and teachers reflect on the effectiveness of learning and project activities and finally students give, receive and apply feedback to improve their process and products (Krajcik & Shin, 2014; Miller & Krajcik, 2019). In this way, students besides developing their technical and expertise skills develop the skills needed for project work, the 21st-century capabilities (Häkkinen et al., 2017). Lampert (2010) describes PBL as an approach based on the assumption, that students are competent to use a wide range of resources to create meaning and new insights and products.

The PBL approach is widely used by many universities and its effectiveness is already researched. Zhang & Ma (2023) presented a study of the impact of PBL and realized, that the effectiveness of the method is influenced by many variables like country region, subject area, type of course, academic period, group size, and experimental period. They realized that using PBL engages the higher education students of engineering and technology subjects applied in laboratory classes, in small groups of 4-5 students, and for a duration of 9-18 weeks. Almulla (2020) investigated the effectiveness of using this approach to engage students in learning. The collected data analysis has demonstrated a positive effect engagement of higher education students especially in STEM education (Ralph, 2015), as well as other similar studies (Häkkinen et al., 2017; Kokotsaki et al., 2016).

Viro et al. (2020) in their research realised, that the development of teamwork skills was found the most important characteristic of the BPL by the teachers. In the background of this attractive method, most teachers acknowledge the technical issues and setting learning goals as collaboration, time, and organization of the projects as significant challenges in the implementation and realization process (Viro et al., 2020; Aksela & Haatainen; 2019). These are the reasons, why teachers prefer to use the PBL outside of regular lessons.

2.2 SCRUM

Agile management methods were declared for the first time as part of "The Agile Manifesto" by Beck (2001) and related to changes in the field of project management during the development of software that meets the client's requirements. Their advantage is that they can react better to the frequent changes present in practical software design. The most frequently used agile methods are Kanban, eXtreme Programming (XP), SCRUM, lean software development, feature-driven development (FDD), and crystal methodologies (Dingsøyr et al., 2012). Agile methods are a designation for various non-traditional frameworks, methods, and approaches. Their advantage is flexibility, transparency, quality enhancement, project team, stakeholder engagement, etc. One of the methods that has found application in a wide range of areas, especially innovation and education, is SCRUM. The main ideas and principles of this method are focus on the customer, continuous improvement, visual management, flow of work, and waste reduction. SCRUM could be described by three groups of components (Figure 1): SCRUM Team Roles (SCRUM Master,

Product Owner, and Development Team), Artifacts (Product Backlog, Sprint Backlog, and Increment), and Events (Sprint, Sprint planning, Daily SCRUM, Sprint Review, and Sprint Retrospective).

Figure 1: SCRUM description



Source: Ravulapalli, 2018.

The SCRUM methodology was modified to EduScrum to copy the needs and specifics of an educational process. This approach has already been applied in various educational institutions, in the education of various subjects. The main idea behind SCRUM theory is based on three pillars: transparency, inspection, and adaptation (Scrum Guides, 2020). Transparency ensures that all tasks, processes, and their fulfillment are always visible to all team members and to the people for whom the product is created.

SCRUM was, similarly as in practice, also in education, first implemented in software engineering education including various approaches such as SCRUM-X (Lee, 2016), SCRUM Game (Rodriguez et al., 2022), use of LEGO-based simulation game (Steghöfer et al., 2017; Bourdeau et al., 2021) education gamification using Minecraft (Schäfer, 2017), etc., followed by other STEM subjects such as mathematics (Duvall, Hutchings, & Kleckner, 2017), currently, it is also implemented in other interdisciplinary fields (Gestwicki & McNely, 2016). Rodriguez, Soria, and Campo (2016) researched significant differences in positive shifts in students' activity level, positive attitude towards the SCRUM-based project management, and improvement in students' soft skills level.

Based on research, it is possible to describe the benefits of using SCRUM in education:

- Positive impact on the development of students' soft skills, i.e. oral presentation, punctuality, leadership, decision-making, time planning, leadership, and responsibility (Valentin et al., 2015).
- Higher students' engagement, because it helps to clarify the meaning of learned topics (Cubric, 2013).
- More frequent communication among students in teams and at the same time with the teacher who gives feedback to the team more often (Cubric, 2013).

The SCRUM is mostly used with project-based learning, where the main goal is to produce the final product (the project-based method outcome) produced by simulating teamwork in small groups (based on the agile approach) (Paez, 2017). Due to the fact, that SCRUM is implemented in different forms of education, its implementation is also subject to different modifications related to the principles of education organization at a given educational institution or level of education. Muller-Amthor et al. (2020) indicate several possible modifications for Higher Education (HE): Learning goals are written as User Stories listed in the Product Backlog, Sprints are spanned a week or longer time depending on the lesson frequencies, the SCRUM-HE Daily Scrums could take place without physical

presence, etc. When implementing the traditional PBL approach, students often wait until the last minute to work on a project, which is reflected in the lower quality of the performances (Kudiyala & Dulhare, 2015). Villavicencio et al. (2017) reported that the introduction of the SCRUM has the potential to eliminate this deficiency because it is necessary to work on the project continuously during the separate sprints and their continuous evaluation. The other benefit is the fact that the SCRUM master is a student who manages the team, and a teacher acts just as guidance to avoid the "loss" of the students and their helplessness (Pears & Daniels, 2010). This leads to more effective self-organization of the learning process as well as to the development of soft skills.

We also encountered the above-mentioned problems, so we decided to implement the SCRUM approach and followed by analyzing different data to check if it could be beneficial for our project-based learning.

3 Innovation of Education in the Field of Business Informatics

Course Informatics II is a compulsory subject taught in the first year of the bachelor's degree. The course aims to acquaint students with business informatics and concepts related to this area, data in the company, i.e. show how and where the data is generated, and how it is processed and used for management within the framework of the individual levels of management. Within the course, students learn about the principles and methods of process and data modeling and their interrelationships, the possibilities of implementing these methods in the environment of real companies, and learn to practically create basic models used during the design of business information strategy. As part of the course, students are accompanied by work in various applications, which show them the individual stages of working with data within the enterprise.

The course is realized in person by a combination of lectures (focused on the explanation of basic concepts and terminology, interspersed with lectures by people from practice, who directly point to the use of the acquired knowledge in the practical environment of the company) and practical exercises in PC labs (aimed to develop practical hard skills focused on the solution of individual partial practical problems, formulated in such a way that can apply the knowledge gained during lectures or by studying online study materials). These face-to-face lessons are more concerned with achieving hard skills.

Besides traditional lectures and lessons, students must participate in semestral projects (SP), whose objective is to design some kind of innovation within a virtual company by using its data. The semestral projects are targeted at soft skills development (like analytical, predictive, and creative thinking, communication, the ability to cooperate and negotiate, the desire to acquire new knowledge and self-development, self-organization, skill lines, developed social and emotional intelligence, and much more).

The semestral project's objective is to develop an implementation of a small information system (IS) based on the end user (client) requirements. This project was solved in pairs (in 2021/2022), where the partial roles are switched during the solution. The main task is to simulate the real process of specifying requirements, creating models, and implementing a mini IS with subsequent evaluation by the client. The process of work on the projects could be described by the waterfall project lifecycle. At first, students play the role of a manager (or other responsible employee) of a company, organization, or institution, that has a problem with maintaining information in paper or other form and wants to switch to an electronic version of information management. As part of the assignment, they must identify the problems that the proposed IS can solve and, through the formulation of user requirements, propose the parts and functions of said IS. These requirements will serve as a springboard for future IT (information technology) specialists

during the implementation of your desired IS (which is a colleague from his/her pair).

What is important to mention is that students have no previous experience in industrial project management and software engineering. The semestral project is an activity outside the school, and it lasts the whole semester (i.e. 13 weeks). The implementation of the semestral project itself was preceded by:

- introduction to SP and its objectives (not only the expected outcomes description but also the education objectives),
- a general introduction to the organization and project management,
- an overview of approaches to project management in general,
- external presentations from industrial project managers (published on YouTube channel),
- a self-study phase followed by regular discussions (10 min. at the end of every face-to-face lecture, online discussions).

The preparatory phase, which takes about 2 weeks, was followed by the implementation phase when students worked on the projects independently. During this phase, they constantly had the tutor and their colleagues at their disposal, with whom they could discuss any uncertainties and problems that arose. After 13 weeks they submitted their solutions to the LMS Moodle, where the assignments were presented to their mate auditory and evaluated by their randomly selected colleagues and the tutor.

As was already mentioned above, in the 2021/2022 iteration it was possible to describe the solution of the semestral project by the so-called waterfall principle of project management. In this case, the project and its solution gradually evolve over time, but it often happens that a student, due to lack of experience with a similar project and a given area of implementation, discovers the errors or shortages in the solution at the end of the semester, just before the deadline for submitting the solution itself. At that time, it was very difficult to redo the whole project in case of a serious error. Students highlighted this shortcoming as the most frequent reason for their failure. We already had positive feedback on the use of PBL in the educational process in the past, but the problem was often the lack of possibility to work in a team, poor time management, and inappropriate/unclear communication on the part of the assignor of the problem. This phenomenon was one of our motivations to improve the project itself and increase its positive effect on the students. The SCRUM method and its principles allow us to avoid the above-mentioned problem, allow students to discover their strengths and weaknesses, and to know how to use them when working in a team therefore, we decided to implement it in the project.

As mentioned above, agile techniques are more beneficial in the management of innovative projects, especially in the field of IT. Because we aim to develop a small information system for the chosen company in the year 2022/2023 we introduce the SCRUM method into the semestral project, which presents a real small IT project. Based on the research done by Fernandes et al. (2021), the SCRUM method helps a student to develop project assignments more smoothly and more clearly and effectively showing how to manage all necessary activities to succeed.

Because they are absolutely new in the field of Business Informatics, project management, and especially SCRUM, we prepared for them a special e-book devoted to the SCRUM approach and divided the semestral project outcomes based on the SCRUM terminology. The following roles have therefore been clearly defined in the framework of the project solution:

- Product owner – teacher responsible for classroom planning, the definition of the roles, and construction of work so that students get understanding and meaningful learning. The teacher prepares the Product Backlog, the acceptance criteria, and other important information connected to the semestral project.
- SCRUM master - the member of the team elected by the other team members, responsible for eliminating the obstacles that arise during the sprint period. SCRUM master

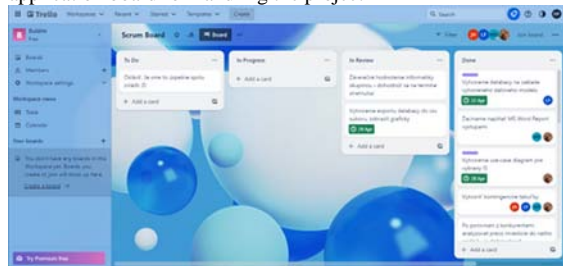
was responsible also for communication with the Product Owner and for leading the meetings, task planning, communication management, etc.

- SCRUM team – students - team members cooperating on the semestral project solution.

Students had the opportunity to create teams at the beginning of the semester, but after the set deadline date, the teams were randomly generated. Each team worked on a project for a company (it could be fictional, or they could be inspired by a real operating company). The role of the teacher (as a product owner) was to consult with the SCRUM masters during the solution time and point out the possibilities of using the individual topics discussed in the framework of face-to-face education. SCRUM team is empowered to self-organize. During the semester, SCRUM masters had regular consultations with the Product Owner, who was a teacher. Since we left the SCRUM organization in the students' hands, they could define their own SCRUM sprints and their length as well as other project management parameters.

The three main parts of the SCRUM Theory need to be filled: transparency, inspection, and adaptation. We have tried to implement all this in the framework of team management using the Trello application (Figure 2).

Figure 2: Example of one of SCRUM teams using the Trello application board for handling the project



Source: Authors.

As stated in (Scrum Guides, 2020), for the success of the method it is important to plan so-called SCRUM events, which should not last longer than one month. To ensure this, we have made the situation easier for the students by outlining the sequential tasks and their quantity. This way, they won't have to plan the solution from sprint planning to retrospective over a longer period during the semester. The product backlog was defined by the 6 user stories with acceptance criteria and had been defined by the teaching professor in his role as the product owner.

During the Sprint Review inspection, the teacher (Product Owner) checks the team's activity and particular draft versions of outcomes, and the existence of other team events within the Trello boards (Figure 3). In case of large deviations from the expected results, the SCRUM Master is informed and has the opportunity to discuss them with the Product Owner. The Product Owner proposes strategies to improve or rebuild the particular user story.

Figure 3: Example of partial solution of a user story of semestral project



Source: Authors.

The final evaluation of the semestral project took place in two ways - the quality of the outcomes was evaluated from the point of view of technology (i.e. the achieved value of hard skills) and at the same time, the students presented the summary information about their productions but also about the sprints and a retrospective on the whole course of their SCRUM teamwork (i.e. the development of soft skills). During this review team presents how the developed outcomes meet the acceptance criteria. The Product Owner is responsible for validating and evaluating the work and giving the feedback to the students (as points and also the verbal feedback and conclusion).

4 Methodology

This research was focused on monitoring and analyzing the success of PBL implementation and integration of the SCRUM method into PBL in the framework of the Informatics II course, which is taught in the first year of bachelor's degree studies. This paper aimed to analyze whether the introduction of the SCRUM method has a positive impact on the course of study and the results obtained by students. For the purpose of the study, we compared two years when PBL was implemented alone and then with SCRUM integration. We were interested in how course feedback would change, whether project work would be a greater contribution to the final course grade, and what benefits the students themselves identify. Based on the research we construct three main research questions:

1. How will the introduction of PBL and SCRUM in the semestral project affect students' outcomes?
2. Will the introduction of these methods have an impact on the development of students' soft skills?
3. Will students perceive the introduction of SCRUM positively?

To find out the actual situation, we analyzed the results of the students in the framework of assignments, and exams, and students' opinions gained thanks to the feedback. To be able to realize the research we need to collect the following data:

- Number of students and teams.
- Types of available outcomes and evaluation types,
- Evaluation of the course by students and teachers,
- Intermediate, partial, and final grades of the students.

All of these data are available in the university academic system and LMS Moodle which is used for learning process support, publication of important information for the students, and collecting students' assignments. These data were then used in the development of the big picture of the semestral project and its role in the subject as a whole.

In addition to quantitative data, we collected also qualitative data. We used questionnaires to obtain students' opinions, as they are also used in several other publications aimed at evaluating the benefits of the teaching methods. This is a similar approach as used in multiple other studies (e.g. Assaf, 2018; Beier et al., 2018; Almulla, 2020). We were especially interested in the students' opinions about the newly implemented SCRUM method. We collected students' views on the use of the SCRUM method in two ways: in the feedback session and then in the semestral project presentation, where students had to present a retrospective of their SCRUM (duration of the SCRUM sprint, positives/weaknesses, task distribution, project workload, team conflicts, difficulties, and solutions, etc.). Within the feedback framework, main questions were created on the MSLQ (Motivation and Learning Strategies Questionnaire) theory (Pintrich et al., 1991). Especially those concerned with motivation (intrinsic and extrinsic goal orientation, task value, control of learning beliefs) and learning strategies (time and study environment, peer learning, help-seeking). We used different types of questions in the feedback: closed and open-ended. Closed questions imposed the Likert scale, where students could indicate the level of their agreement (or disagreement) with some predefined statement related to a part

of the study that they had just completed. To avoid any errors and points of confusion, the feedback questionnaire and its composition were verified and validated by a psychologist and other colleagues participating in the course. At the same time, we pre-tested it on another, smaller group of students attending a similarly focused course.

The observations were carried out in two academic years (2021/2022 and 2022/2023), i.e. after the COVID-19 pandemic, when students returned back to school for full-time study and thus had approximately the same conditions for completing the course.

The study involved 195 students in the year 2021/2022 and 118 students in the year 2022/2023. These are first-year students of bachelor's degree in Finance, Banking, and Investment. As part of our study, we analyzed the SP assessments of all students who had worked on it throughout the semester. However, the evaluation of the SP was included in the final course evaluation. Those students who had not passed the credit exam could not participate in the feedback questionnaire. Because of this, only a certain percentage of students, specifically 67.18% in 2021/2022 and 82.20% in 2022/2023, were able to provide their opinions for our evaluation. As was mentioned above, students were divided into small teams while they were working on the SP. In the year 2021/2022 were divided into pairs and we have a total of 97 teams. In 2022/2023 we introduced the SCRUM method, and it was necessary to create more numerous teams as our goal was to support the soft skills of the team members. Based on the Scrum guide (EduScrum, 2020), we decided to create 24 teams of 4-5 members.

We evaluated the results obtained by the students after the course using statistical methods (normality of distribution tests, nonparametric tests, etc.). The results of the online questionnaire were used for exploratory analysis. Quantitative feedback results were obtained by calculating basic characteristics (frequencies, averages, etc.). Qualitative feedback results from open-ended responses were obtained through content analysis (Worthington & Whittaker, 2006; Krippendorff, 2019). Open-ended question answers, the data was analyzed by reducing its pre-defined categories, whilst also acknowledging the themes arising from the data (Cohen et al., 2007; Markula & Aksela, 2022). Based on the achieved results, we formulate the conclusions and challenges for further course improvement.

5 Results

As mentioned above, in the framework of the study we were interested in the impact of the introduction of the SCRUM method into PBL. Therefore, we compared the results of students in year groups where the semestral project was implemented using the PBL method and PBL enriched by SCRUM. After the initial processing of the obtained data, we found that the basic indicators (such as the number of successful graduates of the course) increased significantly. Since this phase of research, we did not analyze this phenomenon in depth in terms of identifying the influencing factors and their interplay.

The overall indicators show a positive trend. While in 2021/2022 only 67.18% of all students passed the practical test and 64.62% of students passed the subject overall, in 2022/2023 we see an increase in both indicators. Since the only change that has been introduced in the course is the implementation of the SCRUM method, it is possible to conclude that from a general point of view, this change has a positive benefit for the course. The most important difference is the need for teamwork in solving the project, which we assume has resulted in greater communication and cooperation among students in other aspects of the study of the subject. To be able to confirm this assumption, we have carried out a further examination of the collected data.

To compare the results of students taught using the SCRUM method and without it, the comparison between two iterations of the Informatics II course was conducted. As long as the SCRUM method was used in the development of the semestral project in

2023's iteration, only scores for the semestral project were considered. The comparison was conducted with the scores of the semestral project of the year's 2022 course iteration.

Following table (Tab. 1) presents the summary results we obtained in both years.

Tab. 1: Comparison of basic overview indicators of the subject

Indicator	Academic year 2021/2022	Academic year 2022/2023
Number of students	195	118
Number of students passing credit exam	131	97
Number of students passing the course	126	96
Percentage of students successfully passing the credit exam	67.18%	82.20%
Percentage of students successfully passing the course	64.62%	81.35%
Average credit exam evaluation value (max. score 40pt)	27.35 pt (68.38%)	26.84 pt (67.11%)
Average final exam evaluation value (max. score 60pt)	43.20 pt (72.00%)	46.11 pt (76.84%)
Average overall course final evaluation value (max. score 100pt)	70.63 pt (70.63%)	72.94 pt (72.94%)

Source: Authors.

In 2022 semestral project was evaluated with a maximum of 30 points and 195 students managed to elaborate on the semestral project. These scores were adjusted to the same basis as the maximum score of 2023, which was 40 points, by multiplication by a value of 1.33. The number of relevant students' semestral projects in the year 2023 was 118. The adjusted mean score for the 2022's semestral project was 21.95 points (SD=10.101) and the mean score for the 2023's semestral project was 27.62 points (SD=10.925). This suggests that the SCRUM method used in 2023's semestral project led to better results in students' achieved scores.

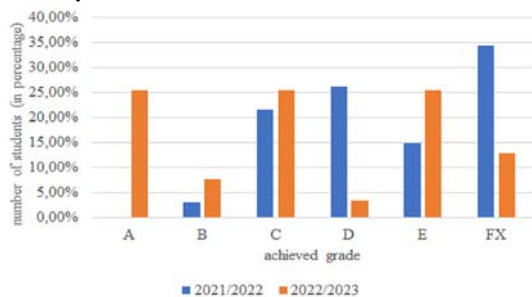
To investigate the statistical significance of these increases in the scores, it was necessary to conduct proper statistical tests. In order to choose the proper test, the normality of distribution was tested by Kolmogorov-Smirnov (0.141, sig.=0.000) and Shapiro-Wilk (0.906, sig.=0.000) tests of normality. Both tests indicated that the scores were not normally distributed. Therefore, a nonparametric Mann-Whitney U test was conducted to identify if the difference in students' mean scores between the SCRUM and non-SCRUM educational approach was statistically significant. Mann-Whitney U test was conducted using IBM SPSS statistics software on adjusted students' scores for semestral projects for both years.

Mann-Whitney U test reported a Z score of -5.133 and a 2-tailed p-value of 0.000 indicating a significant result (at the level of $\alpha=0.05$). Mann-Whitney U test results indicate that the difference between SCRUM and non-SCRUM educational methods in semestral projects' results is statistically significant. Therefore, it can be concluded that the use of the SCRUM method brought better educational results in this case.

As far as SP is concerned, we were also interested in a possible shift in the quality of the submitted assignments. Based on the comparison of the scores obtained by the students within the individual year groups (Figure 4), we can conclude that after the introduction of teamwork, there was an improvement in the quality of submitted projects. In the academic year 2022/2023, there was an increase in the number of projects of excellent quality (25.42%), an increase in the value of projects in the

upper scale of assessment scores, and a decrease in the number of projects with the lowest quality by 21.65%

Figure 4: Comparison of semestral project ratings in different academic years



Source: Authors.

In addition to the quantitative indicators, we were interested in obtaining and evaluating qualitative indicators via a course feedback questionnaire. The questionnaire was extensive, containing 68 questions focusing on different aspects and parts of the course, but due to the focus of this article, in the following, we only present the results related to obtaining students' opinions on areas connected with the use of the SCRUM method in the course. The questionnaire was completed by 97 respondents, i.e. every student who successfully completed the course in the academic year 2022/2023.

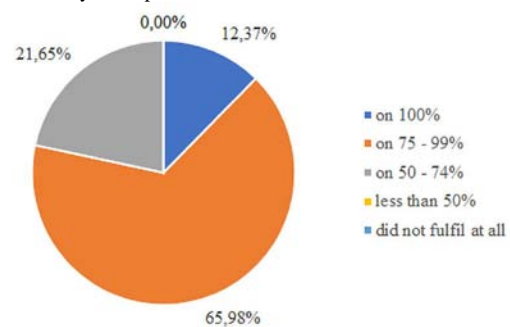
Similarly, to the evaluation of the whole course, the questions focused on the evaluation and students' views on SP were divided into categories using the MSLQ method, i.e. we were concerned with mapping students' motivation and learning strategies. Learning strategies cover the fields such as time and study environment, peer learning, and help-seeking. As the semestral project was more complex, we were first interested in whether the students were sufficiently satisfied with the information provided before the actual implementation of the project and whether the given materials prepared them for the solution of the project. The answers show that 91% considered the information and materials provided to be sufficient and 9% did not know how to evaluate the materials, while 69% of the respondents also found the information to be understandable. Our experience shows that regular work on the project is an important factor for successful project processing because due to its complexity, it is challenging if students leave all the work on the project for a short period of time just before the deadline. Therefore, we were also interested in how regularly they worked on the SP.

The answers show that 82% worked regularly, which can be seen in the achieved results, and 7% declared that they did not work on the project regularly, but rather at the end of the deadline. Around 11% of respondents did not want to comment on this question. At the same time, we were interested in what they considered to be the most important obstacle in the development of the project. The majority of students identified team harmonization as the most important obstacle when working on the project (24.74%). This is because students work on such a project first at the university study, and they do not know each other from other courses where they learn in smaller groups. Therefore, at the beginning, it was really difficult for them to get acquainted with the subject and the objectives of the SP, as well as with their new colleagues, and to get in sync with each other. However, when asked what they learned while working on SP, the most frequent answers were to work in a team (40.20%), to apply the knowledge gained to a practical problem (36.08%), to meet deadlines (18.56%), to work in an environment simulating a company (16.49%).

Motivation covers fields such as external and internal motivation, orientation to the course objectives, task value, and control of learning beliefs. Every conscious activity of man is performed with some expectation. Therefore, we were interested

in whether our graduates also had fulfilled expectations after completing the course. The questionnaire shows that the course fulfilled students' expectations (Figure 5) on varying levels. Satisfaction with the subject was the highest at 75-99%.

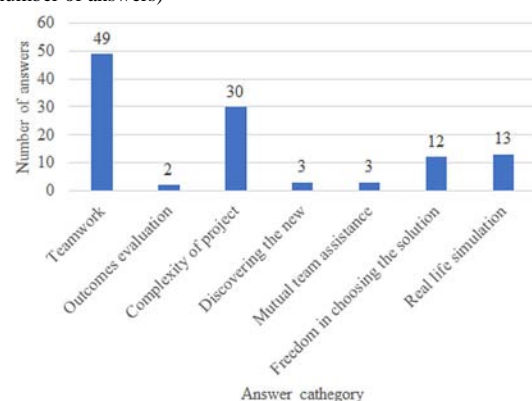
Figure 5: Respondent's answers to the question "How did the course meet your expectations?"



Source: Authors.

Another good signal is the fact that 81% of the students consider the completion of the SP as a benefit and 92% of the students found the SCRUM-based SP interesting. To find out what the students enjoyed most during the project, we asked them an open question. We then categorized the individual answers based on the content of the answer and the frequency of occurrence of keywords from that category. Based on the achieved answers, we have obtained the following categories: working on time (i.e. regular meetings with classmates, forming team habits, the need for cooperation, etc.); the possibility of evaluating and presenting the created in front of an audience of other students; the complexity of the task (which represented the possibility of creating specific performances, so that everyone in the team was able to find an area within the subject that could be applied here and was closest to him; discovering the new (for example, working in an application that was not introduced during the course - the need to learn something new independently); mutual team members assistance/help; freedom in choosing the solution (as only acceptance criteria were given, but not the exact description of the outputs - strengthening creative thinking); real-life simulation (i.e. simulation of the solution of the project in the company). The obtained numbers are presented in Figure 6.

Figure 6: Students' most interesting part of SP solution (in number of answers)



Source: Authors.

Some responses included answers that could be assigned to more than one described category. These responses were assigned to every of the possible categories defined by us. As can be seen from the graph, the most frequently mentioned answers include categories such as teamwork and complexity of the project, which could lead to confirmation of our assumption. The complexity of the project allowed students to choose the area where they felt most confident and could express their talents.

The teamwork helped them to share their knowledge, especially in the process when they needed to approve the performance as a team. And this was only possible after explaining the partial solution to the other colleagues in the team.

During the project management, based on the interim control, we were able to identify two groups of teams. The first type (approximately presented by a quarter of the teams), which, despite the instructions, introduction to the SCRUM issue, continued to apply the Waterfall method instead of SCRUM in the project management, and these groups subsequently had difficulties reacting to the proposed changes, because it would mean in some cases a significant reorganization in a team, time schedule or similar. This type of team didn't use the Trello application for project management, but other applications e.g. MIRO, MS Teams, and MS Excel supplemented with Messenger for the exchange of reports within the team. The second type of team studied and tried to practically implement the SCRUM approach during the project solution and intensively cooperated with the product owner, which transferred to a higher quality of the team outcomes. These teams also actively used the recommended application, which allowed them to monitor changes and solve problems in a short time.

In terms of building teamwork skills, we have observed different situations and approaches of team members to solving project tasks. Some teams had to cope with the loss of a member. In several cases, a team member suddenly stopped cooperating for some reason (health problems, lack of interest, a part-time job and lack of time to participate in the project, quitting the study, etc.), but on the contrary, in some teams, the members continued to work on the final products even though it was clear to them that they would not finish the course this semester (e.g. they did not pass credit exam, final exam, etc.). In the future, it would probably be a better way to explain in more detail the benefits of the SCRUM method and to give more support to the teams (e.g. teachers could more often enter into the management of the project solution, emphasize the need for shorter sprints, etc.).

In addition to the identification of the types of teams, we also discovered several shortcomings related to either the assignment of the project itself or the description of our requirements and their relevance, especially from the point of view of solving projects using the SCRUM method. These shortcomings will need to be addressed in more detail in the next academic years. Among the manifestations of these shortcomings, we can include shortcomings in the students' performances, such as e.g. insufficient elaboration of the result reports, insufficient or completely missing analysis of the current state of the company, and clear identification of the innovation they would like to implement, non-delivery of some performances because they represented only an intermediate step between specific performances of user stories. Thus, we did not assign them any score, which the students automatically considered irrelevant to pass. Finally, we could also identify incorrectly prepared retrospectives of SCRUM teams which resulted in difficult identification of problems in time when solving the project.

6 Discussions and research limitations

The main objective of our research was to find out whether the use of PBL with SCRUM has any impact on the results obtained by students. As we described above, in the academic year 2022/2023, the number of successful students increased by 15.02% in the case of passing the credit exam and by 16.73% in the case of graduating subject Informatics II. Surprisingly, the average number of achieved points within the credit exam decreased slightly when comparing it to the year 2021/2022. From our point of view, this situation is the result of collaboration and more involvement of students in teamwork on the project, where even students who do not have sufficient technical skills had to work on the development of the project solution and thus use their knowledge from face-to-face classes. On the other hand, in the overall evaluation, the students were more successful, which is again a manifestation of cooperation and teamwork. Teamwork is a significant factor that was also

reflected in the quality of the SPs delivered (Figure 4). The teamwork was initially difficult for the students, but the results obtained in the PBL were good with few exceptions. As many as 81% of the students considered working on the SP as a benefit.

One of the problems of PBL is the regular work and the constant involvement of students in the project. Through discussions with students and interim checks during the semesters, we found that in case of problems, students helped and assisted each other when there were any irregularities, which is in accord with the results of multiple other studies (e.g. Crowder & Zauner, 2013; Zhou 2012). They also identified the organization of time as one of the crucial problems. Our results suggest the assumption that by the introduction of SCRUM, it is possible to reduce the level of these impacts. As many as 82% of the students confirmed that it was necessary to work on the project transversally if they wanted to achieve the set acceptance criteria in the individual user stories. At the same time, the students also confirmed the improvement of their soft skills, especially in the area of teamwork, application of acquired knowledge in solving practical problems, and the ability to meet deadlines, with 92% of them describing SCRUM-based SP as interesting. This result can be considered excellent, especially when we worked with the SCRUM method for the first time.

Our achieved results correspond with research results presented by Mahnic and Drnovšek (2005), where authors, based on their experience with the implementation of the SCRUM method in Computer Science Education, found that the use of SCRUM in education increased students' motivation and sense of responsibility for the success of their project. In addition, students had the opportunity to develop their talents within the team, as it was not defined who had what role to play, but the team managed itself based on the knowledge of their personal preferences and skills. Mahnic and Drnovšek (2005) also point to the fact that working on the project allowed students to grow not only as team members but also as individuals.

Like the findings presented by Milašinović and Fertalj (2018), we also gained several important insights in the framework of the evaluation of the course implementation: there is no unique view on how long it would be, how would it be organized and who and how will define for example SCRUM team members. Based on the questionnaire answers and our notes made during the SP presentations, 11 teams confirmed that the team members changed their positions during the project, as well as the defined responsibilities for individual tasks within the team, and the requirements for the content of the product created.

The introduction of SCRUM and PBL means that the teacher needs extra time and work to prepare the whole process, while a common problem is the preparation of special materials that allow students to understand the methods and at the same time point out what is essential for the project. It is therefore essential that the instructions produced and subsequently published contain precise characteristics and performances so that teachers can comment on them unambiguously during the evaluation (Markula & Aksela, 2022). This requires a new student performance evaluation approach. As stated, by Zhang & Ma (2023) and Guo et al. (2020), despite the high number of published studies in the field of PBL implementation, it is not always possible to evaluate and compare the performances because many publications do not provide enough statistical information to compare the published works. It would be useful to educate teachers more in this area and to create different manuals and possibly uniform documents where every teacher could find indicators that need to be taken into account when introducing PBL into education so that it would then be possible to realistically assess the impact of the introduction of PBL into the environment of a given educational institution or a specific subject. Our ambition, taking into consideration our personal experience and other researchers' outcomes, is to design a framework for the implementation of PBL at our faculty that will provide a list of important recommendations for the PBL implementation process and a list of indicators, and the possibilities of obtaining them, to be able to subsequently

evaluate the contribution of this method in education from different aspects like cognitive outcomes (knowledge, cognitive strategies), affective outcomes (perception of the benefits of PBL, perception of the experience of PBL), behavioral outcomes (skills, engagement, motivation) and artifact performance, similarly to Guo et al. (2020).

7 Conclusions

The main role of higher education is to provide innovative education for students who will enter the labor market in the future, and it is important to focus not only on the acquisition of hard skills but also to enable them to grow in their competitiveness (Crosling, Nair and Vaithilingam, 2015) and supporting their autonomy during learning tasks (Martín, Potočnik, & Frás, 2017). Project-based learning can meet such needs. PBL emphasizes knowledge construction and innovation competence because it allows students to test and achieve their ideas in the way they want (Krajcik & Shin, 2014).

Different changes were made in the Informatics II course, driven by the aim of encouraging student motivation, enhancing their learning activity, and improving their results. As our research results suggest, PBL is suitable to achieve this, and the results from the surveys conducted over two years and other collected data indicate that students achieved better results not only in PBL-based semestral projects but the introduction of PBL into course finally enriched also results of course as whole. At the same time, PBL affected not just learning outcomes, but it improves their confidence in their technical skills, but also transversal skills increasingly in demand in the business world, that classical methods do not develop (Saunders-Smits and de Graaff, 2003).

As presented World Economic Forum (2022), investing in collaborative learning should translate into an increase in the productivity of the world, which is a fraction of the additional \$2.54 trillion in increased productivity to the global economy. Agile management methods, based on the teamwork principle, also have a demonstrable positive impact on business performance (Langhof, & Wilkens, 2021), and more and more organizations are planning to implement it soon, up to 70% of enterprises in the next three years (Weichbroth, 2022). As is presented in Brower (2022) the agility and implementation of agile approaches have a growing tendency and represent one of the tools of successful innovative project management. Around 65% of surveyed organizations (McKinsey, 2021) confirmed the significant impact on their financial performance after the transformation to an agile-based organization. The most frequently used method is SCRUM, which is used by 78% of users (enterprises) who have already implemented agile approaches. As mentioned above, the SCRUM method was originally developed for the innovation environment of software development, but it is gradually finding its place in project management in other areas of practical life. A similar situation is also in the field of education, where this method is implemented mainly in the framework of Computer Science Education (Sutherland, 2004). Our paper was intended to point out the possibilities of using this method in economics education, although in this case, it was also a technical field - business informatics. It is important that graduates of higher education gain as much practical experience as possible from the approaches taught in practice during their studies so that after graduation they can participate more effectively in the development of the economy and society as soon as possible.

As Schwaber (2004) states, frequent inspection throughout the life of the project is important for the successful implementation of the SCRUM method. This fact was confirmed by our results: teams that communicated more intensively with teachers as product owners achieved better results in the final SP evaluation than teams that relied only on their interpretation of the project assignment. In these teams, communication was ultimately difficult, and producing results was more complicated. Students had to laboriously modify their performances several times, change the responsibility for a given performance in time, etc. In

these teams, it was often a problem that the SCRUM master and his team did not develop the so-called Sprint backlogs, which complicated the teachers' interim control. In the framework of the Trello application, it was possible to follow at least the discussion of the individual expected performances and the gradual addition of these performances.

The success of the SCRUM method is hidden in the loss of the classical approach to project management, such as the Waterfall method, and the enhancement of collaboration in time and participation of team members not only in the solution and development of outputs but also in its self-management. The SCRUM Master is not a team manager in the true sense of the word, but rather a facilitator and servant leader. As the literature states (Cedere et al., 2020; Seemiller & Grace, 2017) the younger generation wants to participate in the solution of projects but at the same time, they are interested in actively participating in management and decision-making so that they can give their work a deeper meaning. It is therefore also our task to innovate education in this sense. That is why we have decided to "revive" the proven method of project-oriented education, where students acquire real practical skills and implement the acquired knowledge in solving a practical problem, or to make it even more accessible to students by implementing the SCRUM method. The use of this method motivates students to discover new possibilities and to look for innovative solutions. This ultimately enhances students' participation in the education process, which was confirmed by our experiment in the framework of the implementation of the Informatics II course.

Despite the published positive results of using SCRUM in educational settings and its implementation in project-based learning (Fernandes et al., 2021; Cubric, 2013; Dinis-Carvalho, 2019), we have discovered several shortcomings that need to be researched in more detail in the future and solutions for improvement need to be proposed.

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Primary Paper Section: A

Secondary Paper Section: AM

THE IMPACT OF THE PANDEMIC ON THE CENTRAL AND REGIONAL AREAS OF HUNGARY: DURING THE ECONOMIC RECOVERY FOLLOWING THE GLOBAL VIRUS EPIDEMIC

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Abstract: The objective of the article is to evaluate the impact of the COVID-19 crisis on the competitiveness of the labour market in Hungary on the economically most developed central as well as the rural areas to illustrate discrepancy. Indicators related to the effectiveness of recovery regarding both human resource management and corporate management are also analysed. A questionnaire survey on recovery from the pandemic was filled in 2021 by 1184 company managers: 61% were received from the central region while 39% from rural areas. The crosstab analysis was applied while processing data. According to our findings, the backlog has decreased in six Hungarian regions except Western Transdanubia, which has been hit harder by the closures and restrictions. The more moderate development of the central region can be due to the presence of its companies on the global market while the catching up of the rural areas was aided by the wage subsidy of businesses operating there. It is worth examining the impact of economic crises on how the differences between the central and rural regions change and also which regions can benefit from the downturn. In conclusion, a crisis might also serve as an opportunity to achieve a balanced economy and regain competitiveness.

Keywords: COVID-19 pandemic, competitiveness, labour market, level of education, sectors of the economy, territorial units.

1 Introduction

In December 2019, a new disease spread from China, which became a global pandemic within a few days (Agarwal et al. 2020). The coronavirus pandemic arrived in Europe at the beginning of spring 2020 and created an unprecedented emergency situation with important consequences on health, economic and social policies (Wolff & Ladi, 2020). As a result of the pandemic and the adopted anti-pandemic measures, unemployment has been rising sharply in the EU since March 2020.

Given the uncertainty in the market, companies trying to recover by relying on traditional directions may discover that the world they were familiar with no longer exists. The way in which executives managed their plans and actions in the past may no longer be relevant, especially if these plans and actions are focused on a functional or internal view. Organisations that wish to succeed in the recovery and exit phase need to make clear decisions about where, how and when they want to apply the next four steps in order to be competitive.

1. Identifying the destination: visualise what success will look like at the end of the recovery and determine what immediate steps can be taken to move quickly and competitively.
2. Waiting for results: making sure that the path to success is defined by stakeholder-focused results, not by internally-focused functional processes.
3. Running sprints: using agile principles to navigate the uncertainties - beyond the epidemiological factors - that the

organisation must navigate on the way from the current state to the destination.

4. Applying appropriate timing: determining in careful steps when it is appropriate to start moving towards recovery (Renjen, 2020).

The objective of our article is to examine the labour market responses to the crisis and assess its competitiveness after the recovery by highlighting the discrepancies between the central and the rural regions of Hungary.

2 Theoretical Background

The issue of unemployment is an eternal problem. A high unemployment rate has several negative consequences for the economy and society. Pauhofova and Stehlikova (2018) analyzed the behavior of unemployment in Slovakia, Czech Republic and Hungary and found out that in regions with higher unemployment the increase in wages was lower. Unemployment has gained popularity in recent years in connection with the COVID-19 pandemic. For this reason, examining the impact of the COVID-19 crisis on the labour market is a highly relevant issue. Several researchers have studied the effects of the coronavirus pandemic on unemployment. Lambovska et al. (2021) analysed the impact of the COVID-19 pandemic on the unemployment rate under the age of twenty-five in the EU. Aidukaite et al. (2021) documented and compared the social policies (extensive protection for jobs and enterprises) that the governments of Hungary, Lithuania, Poland and Slovakia implemented to combat the first wave of COVID-19 pandemic. Acheampong (2021) investigated whether the coronavirus epidemic impacted differently situation of men and women in the Hungarian labour market. Svabova et al. (2021) examined the impact of anti-pandemic measures on the development of the registered unemployment rate in Slovakia. Orfánusová, Veszprémi Sirotková (2021) examine some another factors in Slovak conditions. However, a detailed comparison of unemployment during the corona crisis in Hungary and Slovakia has not been achieved. The aim of the article is to evaluate the impact of COVID-19 crisis on the labour market of Hungary. The research questions include the following.

RQ1: What is the difference between the economy and the crisis involvement rate of the central region and rural areas in Hungary?

RQ2: Do we believe in the statement "crisis is also a hidden opportunity" and take advantage of opportunities?

In order to illustrate the effects of the coronavirus pandemic on the labour market in the above mentioned EU member states, the progress of the unemployment rate by gender, age, level of education and economic sectors was analysed together with the territorial and temporary distribution of unemployment between 2019 and 2021. Information from the databases of the Hungarian Central Statistical Office from 2019 to 2021 were gathered as these years were directly affected by the pandemic. Both quantitative and qualitative research methods were used in the research. After processing the relevant national and international literature sources, a comparative research method was employed to process data. The results of the study can perfectly be implemented into practice to better understand the effects of the pandemic and the measures against it on the unemployment rate.

Turning to the labour market, we can see that COVID-19 has accelerated trends such as the increase in the number of teleworkers, which could lead to a rapid growth in different types of occupations. Globally, the growing demand for automation, artificial intelligence and digitalisation will drive demand for a wide range of workers, such as robotic repair technicians and 3-D printing engineers (McKinsey, 2021). Also, the crisis changed the preferences of workers on the labor market (Ahmed et al., 2023, Hitka et al., 2023, Grmanová, Bartek, 2022;

Harman et al., 2022; Vojtovič et al., 2021, Ližbetinová et al. 2020, Sirotkova, Kroslovakova, 2016, Ližbetinová, Hitka, 2016).

The idea of core-periphery interactions is largely based on an explanation for the uneven capitalist development that leads to divergence in the development of territories in terms of their economic position and the degree of resource and capital concentration (Williamson, 1965).

The objectives of the core-periphery models have been established by research on the evolution of civilizations and production paradigms, as well as by the impacts of these changes on specific regions at various geographical scales (Ramírez, 2009). In addition to scalar datasets, networks and vector data are increasingly being used to analyse the core-periphery linkages (Borgatti & Everett, 1999; Erlebach et al., 2019). A fractal-like pattern can be seen in the interlinkages between peripheral locations in global, national, regional, and local structural relations (Kühn, 2014; Erlebach et al., 2019; Halás, 2014).

The core-periphery dichotomy is a fundamental paradigm in the social sciences. Immanuel Wallerstein defined its dual meaning by extending this bipolar idea and defining "semi-periphery" (Wallerstein, 1976). According to Kühn (2014), the phrases and ideas of core and periphery are related and derived from one another.

Hence, classifications can be used to detect the varied meaning and substance of peripherality. Certain regions can be categorized as marginal zones because they are isolated (isolate) and blind-spot (angle mort) places (Leimgruber, 2007). Four categories of regions—geometrical, ecological, economic, and social—were presented as part of the conversation about geographical marginality (Leimgruber, 1994). Nemes Nagy (1996) distinguished between locational (geographical), economic (level of development-related), and social (political power-related) approaches when examining the core-periphery relationship.

In relation to peripherality, Hungarian scientific discourse and regional policy frequently emphasize two factors: outlying places with poor access to transportation (e.g., Tóth, 2006; Lócsei & Szalkai, 2008; Kiss, 2012); and underdeveloped social and economic areas (Nagy et al., 2012). In the case of Hungary, these factors interact, leading to socioeconomic issues that are exacerbated by the possibility of exclusion due to transportation (Tagai et al., 2019)

The Central European nations' backwardness may also have been influenced by unfavourable social-demographic traditions. The marginalization of the periphery was made worse by the inability of some territories to benefit from the general economic development in the final decades of the 19th century (Pénzes & Demeter, 2021). Before the Trianon Peace Treaty (which, at the time, divided Hungary's geographic makeup and economic structure), undeveloped areas began to appear with notably unfavourable socioeconomic indicators, while the latter also had negative effects on the borders (Demeter, 2018; 2020; Szilágyi, 2019; Péntzes, 2020).

3 Research objective, methodology and data

These backward areas were not only observable in the interwar period (Szilágyi, 2019), but some have persisted even up to the present. Beside these, the territorial changes after Trianon determined the enormous strengthening of Budapest within the spatial pattern, one that can be regarded as monocentric notwithstanding the attempts of the regional policy in the 20th century (Pénzes & Demeter, 2021). In the mid-1970s, the scientific study of peripheral (i.e., "unfavourable") communities began (Beluszky, 1976). It examined the regional variations in living conditions with a focus on the availability and accessibility of institutions of infrastructure.

It is worth examining how the pandemic caused by COVID-19 affected the territorial backlog (Kovács et al., 2020; Petó et al.,

2022). The backlog in percentage has decreased in six Hungarian regions, except for Western Transdanubia, which has intensive relations with Austria and Slovakia (Table 1). This region has been hit harder by the closures and restrictions. Residents do not perceive the reduction of the percentage backlog since the total backlog has increased.

Tab. 1 The reduction of the backlog of countryside regions in Hungary

Analysis of GDP per capita in Hungary, thousand HUF							
	2019	2020	2021	2019 percentage backlog	2021 percentage backlog	2019 total backlog	2021 total backlog
Central Hungary	7 501	7 592	8 689	100,00%	100,00%	0	0
Central Transdanubia	4 498	4 478	5 303	40,03%	38,97%	-3 003	-3 386
Western Transdanubia	4 731	4 685	5 158	36,93%	40,64%	-2 770	-3 531
South Transdanubia	3 312	3 372	3 876	55,85%	55,39%	-4 189	-4 813
Northern Hungary	3 233	3 357	3 936	56,90%	54,70%	-4 268	-4 753
North-Great Plain	3 130	3 281	3 701	58,27%	57,41%	-4 371	-4 988
South-Great Plain	3 523	3 675	4 113	53,03%	52,66%	-3 978	-4 576
Country total	4 878	4 965	5 677	34,97%	34,66%	-2 623	-3 012

With the cooperation of several universities in Hungary, as well as in Austria, Bosnia-Herzegovina, Bulgaria, Romania, and Slovakia, a large-scale international survey was carried out that examines the changes in corporate and human resource management activities throughout the three phases of the pandemic and the recovery. Figure 1 shows the duration of research phases in Hungary and the number of actively participating public and private companies (Poór et al., 2021/a; Poór et al., 2021/b).

Fig. 1 Characteristics of the empirical phases of the international research in Hungary



The objective of our recent research is to show that the central region and rural Hungary were affected differently by the harmful effects of the pandemic and that differences can also be discovered between the speed and path of recovery. In connection with our hypotheses, we point out disparities between the characteristics and measures of organisations linked to the capital and also to rural areas, which may be the reasons for the various development. The empirical results allowed us to develop the following research hypotheses.

H1: The more moderate development of the central region can be justified by the fact that companies operating on the global market are located here, and these organisations faced difficulties during the pandemic.

H2: The catching up of rural areas was aided by the fact that the wage subsidy was used in a larger proportion by the businesses operating there.

H3: Although the crisis was seen as an opportunity in the central region, it proved to be less successful in taking advantage of the opportunity.

H4: Among the management measures, we find one that was more typically applied in countryside regions, and this measure may also be the reason for the favourable development of the GDP for the countryside.

Due to constraints of length, this publication includes only part of our research. We limit ourselves only to the elements related to the hypotheses.

The questionnaire survey on recovery from the pandemic was filled in between July 1 and November 30, 2021 by 1184 company managers. It can be divided into two parts: 714 responses (61%) were received from the central region, while 456 responses (39%) from the rural areas. Thus, in total, our sample covers 1,170 enterprises. Although both parts of the sample contain many elements, it is not representative. During the analysis crosstab analysis was employed. In certain cases, the ordinal scale was supplemented by the corresponding correlation coefficient calculation. Due to the lack of representativeness, significance is not proof; it only indicates the probability of correlations. SPSS outputs were supplemented by illustrative figures in Excel. On the basis of our hypotheses, we are looking for differences that might explain why the capital and its region were unable to increase their superiority after the pandemic.

4 Results and discussion

We investigated the primary markets of organisations and came to the following result. In the central region, the proportion of companies that produce and provide services for the national market is exceptionally high. The proportion of firms targeting the global market is slightly higher than that of economic organisations in the non-central regions. The primacy of the local and regional target market and those that prefer European customers is more common in rural areas. This may be contributed to the large car factories located in the countryside, as their products reach the European continent (Figure 2). Regarding Spearman's correlation coefficient and the related significance level ($p=0.002$), it was concluded that the target markets are different, which may also be the reason for the different economic results in 2021.

Wage subsidies were also examined, where the calculated correlation coefficient and significance showed no difference, so discrepancy could even be due to opportunities. Despite this, Figure 3 presents that the proportion of organisations examined in the non-central region where wage subsidies were applied to a greater extent is higher. Before the pandemic, such subsidies were received by organisations that employed people with altered working abilities and workers with reduced working hours. People who were already in a difficult situation could lose their jobs.

Fig. 2 Geographical location and the main markets

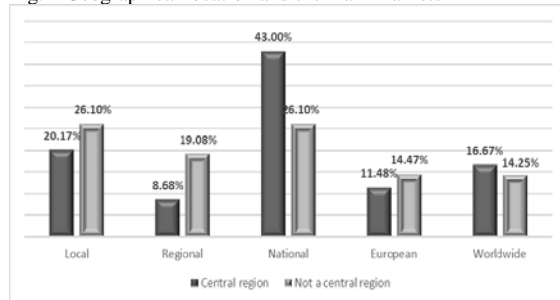
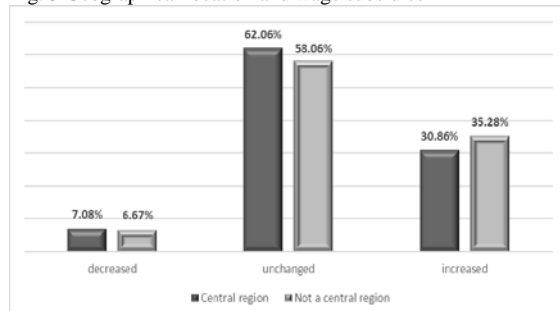


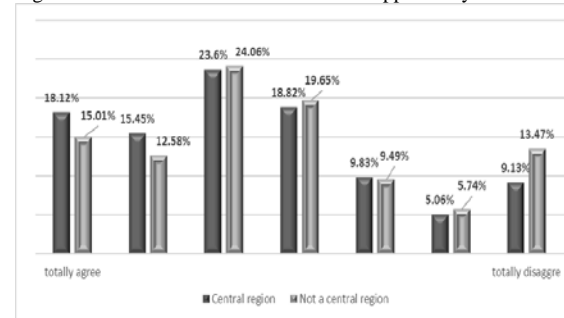
Fig. 3 Geographical location and wage subsidies



One of the most important findings of Jared Diamond (2020b) is that we can successfully prepare for future challenges if we intelligently understand every possible consequence from the

past. Every crisis situation contains the potential for development, a positive change, and taking advantage of the opportunities arising from the crisis. We examined to what extent the organisations functioning in the central region and those in rural areas meet the statement above. The calculated values indicate a weak, negative correlation and significance ($p=0.014$). This means that in the central region it is more typical for managers to think of the crisis caused by the pandemic as an opportunity for change and renewal. The country's central region is more innovative, and a significant part of the R & D expenditure flows here. Despite this, the centre was not possible to fully exploit the potential of the crisis (Figure 4).

Fig. 4 Territorial location and crisis as an opportunity



Managers of responding organizations have indicated which measures they take to speed up the recovery. All the measures we have selected are typical, whether it is for the central region or the peripheral areas outside. Table 2 shows different figures, but only in one case was it possible to show a significant difference with the method we used.

Tab 2 Correlation between recovery measures and geographical location

		Typical	Not typical	Total
No need to do anything	Central region	95.9%	4.09%	100%
	Not a central region	94.45%	5.54%	100%
Increase staff	Central region	96.8%	3.2%	100%
	Not a central region	96.2%	3.8%	100%
Increase investments	Central region	82.5%	17.5%	100%
	Not a central region	84.3%	15.7%	100%
Cost reduction	Central region	73.8%	26.2%	100%
	Not a central region	78.9%	21.1%	100%
Removal of wage freeze	Central region	59.8%	40.2%	100%
	Not a central region	63.2%	36.8%	100%
Increase marketing expenses	Central region	96.8%	3.2%	100%
	Not a central region	97.6%	2.4%	100%

This measure is cost reduction, which is more typical of the non-central region. Increasing marketing expenses and increasing staff are the most popular measures for businesses operating in both in the countryside and central regions.

In the central region, traditional cost reductions were excessively ignored even though this measure also has benefits. If the company restrains itself in the less important value chain elements, it can invest more in creative and innovative products and services. The following part summarises our hypotheses test. Our results are illustrated in Table 3 below.

When examining our hypotheses, we first checked whether our assumption was significantly true followed by categorization. Some of our findings may cause the reduction in the difference between central and peripheral areas. In the case of rejected hypotheses, we cannot claim that the examined factor is the cause of the decrease in the difference between the central and peripheral areas. If the hypothesis was accepted, but the positive result was not achieved, it is a case of underutilization.

Tab. 3 Hypotheses test

	Factors	Fulfilment	Causative	Not causative	Under-utilization
H1	Different markets	Yes	×		

H2	Wage support	No		×	
H3	Crisis as an opportunity	Yes			×
H4	Cost reduction	Yes	×		

Restrictions imposed due to the coronavirus can be interpreted as a negative feature, amplified by supply-side weaknesses (Idris et al., 2022). The sudden cessation of manufacturing activities has triggered the collapse of the global supply chain, which has spread to areas less affected by the virus. Production processes in countries with higher economic exposure have also collapsed. As a result of the mandatory distancing measures, the catering industry and tourism practically ceased to operate, which distributed an immediate blow to businesses and workers in the tourism sector. While examining the labour market data in Slovakia, the reduction in employment rate was most noticeable in the industrial sector followed by retail and wholesale trade, and finally, in the tourism and catering industry.

Similar results can be observed between Slovakia and Hungary in terms of age groups and educational level. The highest unemployment rate was detected in the young adult age group. In terms of education, both countries have the lowest unemployment rates in tertiary education. Based on the data, we observed the problem of the compatibility of the company's short- and long-term interests with the humanitarian aspects for the experts in charge of labour relations. The most interesting result of the study is that the most difficult group to employ is the one with secondary education, as their unemployment rate is even higher than those with primary education. Employers appreciate qualifications only if innovation, computer skills and professional language skills are concerned. It would be worthwhile to examine whether there is a link between job loss and qualification/ language skills. The analysis confirms that in the long term resources invested in education contribute to the stability of the country and reduce the vulnerability of workers in recession.

Working capital investment is extremely beneficial for the host country but there is a serious disadvantage compared to nationally owned companies. During the recession, the capital received may be concentrated on the mainland. Similar to previous financial crises, the pandemic highlights the vulnerability of the industry and export-driven economies during the recession and stresses the importance of diversification.

Before analysing the data, we believed that the central region increased its advantage over countryside Hungary during the pandemic by using its more extensive resources. However, our summary showed a different result. The data draw attention to the fact that some business organisations connected to the capital failed to reduce unnecessary costs, and thus lost the chance to finance innovations and take advantage of the opportunities inherent in the crisis. In our analysis, we investigated the reasons for the different results and found some possible reasons. One of the limitations of our research is that we cannot demonstrate the existence of certain factors from the sample even though they could also have caused the reduction of economic differences. Our sample is not representative, so in addition to the factors found, the possible reasons are the following.

In our sample, enterprises with a larger number of employees and sales revenue are typical in the capital. If this is true for the entire population, then the inflexibility associated with large size hinders development. A possible explanation can be found in the literature as to why the capital's recovery from the crisis took place relatively slowly. The regions have a network of connections depending on the economic activities that take place in them. If these networks are considered robust, they will continue functioning properly if some connections are lost. The lack of robustness leads to disruptions in the operation of organisations (Elekes & Tóth, 2023). Our further research proposal is aimed at examining economic relations, which could decide whether it is legitimate that the central regions suffer more from crises.

5 Conclusions

There have also been opinions that everything depends on the level of regional resistance. The concept is linked to the number of non-agricultural employees. This indicator depends on long-term emigration or immigration, demographic changes, and economic transformation processes. Based on calculations, a map can be created depicting regional recovery. According to the study, recovery from the crisis in Central and Eastern European countries (CEE countries) depends on structural changes and flexibility (Brada et al., 2021). In our sample, trade is more typical of the central region, but tourism and hospitality are not. If the latter is just a sampling error, then the sectoral distribution and the greater involvement of some sectors may be an obstacle to a successful recovery.

Comparing the research conducted in other countries during the pandemic and focusing on organizational behaviour with the regional GDP per capita studies is also feasible. In this way, it can be determined whether peripheral areas are catching up as a common consequence of the health crisis. We can also conclude whether organisations that regard the crisis as an opportunity can take advantage of the opportunities offered. It can be clearly stated overall that the extent of the effects largely depends on the characteristics of the economic and social structure there, and how much weight the most affected areas or groups represent in the region (KSH, 2022; Jaros et al., 2014).

The frequently quoted US historian Diamond (2020a and b) believes that "the real threat to our civilisation is not COVID, but the nuclear bomb, climate change and resource depletion". A similar view is expressed by Honigsbaum (2019:15), who argues that "we should not narrow our interest to some predatory micro-organism", it is important to see the "bigger picture". We would like to support our statement above with the following two phenomena:

- US IT innovator and philanthropist Gates (2020) draws attention to the seriousness of the environmental problems. He observes that, in the longer term, the problems and difficulties caused by the coronavirus epidemic are far less serious than the dangers of neglecting the environment.
- The Russian-Ukrainian War, which is taking place while writing this article, highlighted once again that certain repressed cultural and civilizational trends can sometimes 'go out of control' (Huntington, 2019: 47) as something (e.g., a cold war or a pandemic abatement) passes or subsides. This war also confirmed Roberts' (2021) claim that our world has not become safer over the past decades.

The best antidote to the various threats and challenges indicated above may be 'greater cooperation than ever before [...] otherwise we could have a global disaster on a global scale greater than ever before' (Recna, 2021:32-33).

To conclude, let us finish with a reflection by Gazdag (2022: 20) in our published academic book on Recovery - 'Now the convergence of these global crisis processes has reintroduced a global component of uncertainty into the world economy and even into international politics. All societies, all communities, all countries must now strive to get through these difficult times in the best possible condition, with as little loss as possible. And to do so, we must unite today, putting aside political-ideological differences'.

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COPPER MARKET SENTIMENT, VALUATION AND NEAR-TERM DEVELOPMENT USING SENTIMENT ANALYSIS

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Abstract: This paper examines the development of the global copper market using sentiment analysis to analyse the opinions, feelings, and subjectivities of the research subject. Particular attention is paid to one of the most important international mining companies in the world, Freeport-McMoRan. Texts related to Freeport-McMoRan and the relevant copper market were processed using MS Excel software and artificial intelligence, specifically recurrent neural networks. Sentiment analysis was followed by regression analysis to track the copper price trend over the same period. Confirmed the existence of inverse relationship between the copper price and the results of the sentiment analysis performed. Positive results of the sentiment analysis affect the sentiment of the copper market, thereby affecting the copper price with a time lag.

Keywords: Copper price, copper consumption, copper market sentiment, sentiment analysis, Freeport-McMoRan.

1 Introduction

Sentiment analysis is an important tool for gaining deeper insight into public opinion and sentiment around various topics, copper, valuations and short-term developments. This analysis can be used to monitor whether public opinion on topics is predominantly positive, negative or neutral. For example, in copper mining, sentiment analysis can help identify reactions to changes in copper prices and developments in the mining industry.

Copper is considered one of the most important minerals in the world (Mendiola et al., 2022). Copper as a strategic raw material attracts wide attention due to its price changes (Shen, Huang, 2022). Global copper production has increased more than 80 times in the last 135 years (Stuermer, 2022). Singer (2017) argues that copper demand is not driven by time but by population size and income. Given the increase in population, an increase in demand can be expected, bringing the resource closer to depletion. Understanding the metals market and forecasting price changes can help players plan for future changes in supply and demand (Shojaeinia, 2023).

According to (Harmsen et al., 2013), there has been an increase in demand for minerals in recent years due to the development of the global economy and increased product sophistication. The global transition to cleaner energy sources is intensifying pressure on the mining industry to secure the supply of minerals for the energy transition (Jiskani et al., 2023). The clean energy transitions require a large volume of minerals to handle its diverse technologies (Islam et al., 2022).

The global market has announced copper as a modern energy metal and finds its extensive use in construction, wiring, power transmission lines, alloying, anti-corrosion coatings, heat exchangers, refrigeration piping, etc. (Jena et al., 2022). Copper is expected to play a big role globally as solar, wind and electric vehicles increase (Shojaeinia, 2023). Copper ore is primarily mined from deposits of sulphide minerals (Jena et al., 2022). Copper is essential to achieving a sustainable development path due to its important role in the electromobility and renewable energy sectors. In 2019, 23.5 million tonnes of refined copper were used, with primary copper supplying 86.3% and secondary metal providing the remaining 13.7%. In the future, recycling of copper would increase significantly in terms of primary copper supply to meet the GHG reduction target. Secondary copper production reduces energy consumption by 85% and GHG emissions by 65% compared to average primary sources (Rivera et al., 2021). Humanity is using mineral resources at unprecedented levels and demand will continue to grow over the next few decades before stabilising by the end of the century due

to the economic development of populated countries and the energy and digital transformation (Vidal et al., 2022). An adverse consequence of the increasing demand for copper is the depletion of resources, where resource saving and better utilization can delay their depletion. However, there is no doubt that in the future, a desirable and scarce raw material will no longer be available to humanity (Castillo & Eggert, 2020). According to estimates and speculations concerning the feared resource depletion, it can be expected in the order of decades (Villena & Greve, 2018). According to (Ponomarenko et al., 2021), the depletion of mineral resources will mainly affect economies based on these resources. With the depletion of high-grade copper sulphide deposits, attention has now shifted to recovery from various poor oxide and mixed ore deposits (Jena et al., 2022).

Metal mining is limited by the quantity of metallic raw materials in the crust. Currently, the known mineral deposits in the Earth's crust exceed current ore reserves (Patiño Douce, 2016). Gradual depletion of ores is expected for all minerals (Kuipers et al., 2018). Undiscovered mineral deposits are not likely to occur in sufficient quantities to meet the projected global demand for the remainder of this century (Patiño Douce, 2016).

The primary source of information on reserves and resources is the United States Geological Survey (USGS), which collects extensive information from mines and deposits and all mineral commodities around the world. During the epidemic, some mines, particularly in the United States (US), were closed, reducing US by an estimated minimum of 13 %. Currently, there is a global increase in material extraction. The United States Geological Survey (USGS) reports that global copper production has increased significantly over the past decade. Given the current population growth, there are growing concerns about the availability of raw materials (USGS, 2021).

Reijnders (2021) points out that in the case of copper, unfortunately, there is still no systematic and comprehensive study on substitutability and fungibility for any precious metal. Schipper et al., (2018) use regression and stock dynamics to developed copper demand models with the estimation of until 2100. With the assumption that copper reserves are constant and consumption will occur gradually, due to exponential mining and with the aim of satisfying the growing demand, (Calvo et al., 2017) propose the use of the Hubert peak model which can identify the types of minerals that will become scarce in the next decades. Reaching the so-called peaks does not indicate the depletion of raw materials but rather a warning indicator.

Renner & Wellmer (2020) point to the fact that fluctuations in mineral prices can threaten the economies of developing countries as they are heavily dependent on mineral production. With regard to newly developed technologies, (Korhonen, 2018) states that overcoming mineral scarcity will be achieved through innovation and technology. This is confirmed by (Aydin, 2020), who claims that since the 1980s and the recession in the mining industry, companies have survived mainly due to the introduction of innovation and technological changes, which has led to higher productivity. (Mitra, 2019) points that the development of technology is moving forward, which helps to cope with the detrimental effects of depletion on the productivity of the copper sector. With the growing problems and impending ban on the use of copper in some sectors, it is necessary to look for an effective substitution for copper. This is confirmed even by (Reijnders, 2021), who also mentions the necessity of the substitution of copper in certain sectors, while according to (Henckens & Worrell, 2020), it is impossible to replace copper in electricity transport.

The basic type of substitution is element-for-element, where the existence of absolute scarcity depends on the perceived possibility of substitution. We can speak of absolute scarcity

only if there is no substitute for the given scarce resource, i.e., copper metal in this case. Every scarcity that economics has studied so far has been solved through substitution. To substitute metal X for an alternative or substitute X', it must be first available and have specific, at least partial, substitution properties (Månberger & Stenqvist, 2018).

According to information from the US stock exchange, Freeport-McMoRan's shares rallied sharply in 2021 and 2022 due to the increasing price of metal commodities and market sentiment (PATRIA).

This paper aims to provide insight in the global copper market sentiment over the past few years. Therefore, the following research questions were formulated:

RQ1: How has the copper market evolved over the past few years?

RQ2: What is the sentiment of the relevant copper market that is served by a major mining company?

RQ3: What is the predicted development of the copper market in the future?

2 Literature Review

Kaliyadan & Kulkarni, (2019) address three important aspects related to statistics, namely the element of variables, the aspects of descriptive statistics, and the issue of sampling. Variable is a basic component of statistical data whose value varies. In defining a variable, qualitative or quantitative data can be used. In general, descriptive statistics can be divided into two categories: sorting/grouping and illustration/visual display; summary statistics. Detailed sample size calculation is an essential aspect of a good study design. A statistical creative model was created to address the descriptive statistics problem in mixed methods research using an exploratory sequential mixed methods design. The descriptive qualitative method is used to create statistical creative models, while the existence of significant differences in the statistical creative models is tested using quantitative methods. The results of this research confirmed the existence of three levels of statistical creative model of descriptive statistical activity: imitation, modification, and construction (Malang 2021).

Alvarez Pardo & Barreda Jorge (2020) studied the theoretical, methodological, and practical conditions in which the training process of the art instructor was developed to achieve adequate training in research training and knowledge of descriptive statistics. The students increased their level of commitment, interest, and creativity by acquiring knowledge of descriptive statistics.

Methods of data analysis in the management sciences are becoming increasingly sophisticated, leading to problems that include the increasing likelihood of incorrect performance and/or interpretation of analyses presented in published research, the increasing reliance on statistical significance as the main criterion for evaluating results, and the increasing difficulty in describing the research and explaining the findings to lay public (Murphy, 2021).

Attitudes towards statistics are of interest to many researchers. In this paper, the reliability and construct validity of the Attitudes Towards Descriptive Statistics Education Scale (EAEDE) are examined. The reliability and construct validity of the EAEDE are analysed using a descriptive correlational quantitative methodology. The results show adequate psychometric characteristics of the scale and better fit the theoretical distribution of the items (Ruz et al., 2022).

As such, sentiment analysis aims to automatically reveal the underlying attitude that is taken towards an entity. The aggregation of observed sentiments in a population is represented by opinion polling and is used in many fields, especially in marketing. The current textual sentiment analysis relies on the construction of dictionaries and machine learning

models. With the development of social media usage, a new setting of sentiment analysis is also emerging (Soleymani et al., 2017).

Extracting the latent aspect structure and sentiment polarity helps to discover customer preferences, including the reasons for these preferences. (Almars et al., 2017) proposed Structured Sentiment Analysis (SSA) as an approach to understand the feelings and opinions expressed by people in short texts. The advantages of SSA include a hierarchical tree of hot product aspects, which is automatically extracted from short texts, hierarchical analysis of people's opinions on these aspects, and the generation of a summary and evidence of the results. Experimental results suggest that the proposed SSA approach can effectively extract the sentiment tree from the used texts (Almars et al., 2017).

The proposed modification to the Turney's algorithm should eliminate the need for a search engine using sentiment weights when the general version of Turney's algorithm requires the use of the NEAR Alta Vista operator. The used sentiment weights should be derived from a lexicon of words annotated with its corresponding polarities, allowing the application to run offline and eliminate the need for an external search engine (Das, 2017). The development of e-commerce goes hand in hand with extracting valuable information from consumer comments. The comments are classified either as positive class or negative based on sentiment polarity. Sentiment classification method based on machine learning shows excellent performance and is widely used. Most of the existing research does not consider the semantic relationships between words. Zhang et al., (2015) use a sentiment classification method based on word2vec and SVMperf to extract the semantic features. The experimental results of this research showed the excellent performance of the method in sentiment classification Zhang et al., (2015).

Medhat et al. (2014) define sentiment analysis (SA) as the computational processing of opinions, feelings, and subjectivity of texts. They explore and briefly present many algorithm improvements and various SA applications. Their research is categorized according to the contributions to various SA techniques. The main contributions include categorization of articles and specification of the research trend in sentiment analysis and related areas.

Saif et al. (2016) state that both commercial and public sectors use sentiment analysis on Twitter. Their paper introduced SentiCircles, a lexicon-based approach to sentiment analysis that differs from typical lexicon-based approaches by offering a fixed and static prior sentiment polarities of words regardless of their context. SentiCircles considers the patterns of co-occurrence of words in different contexts in tweets and enables sentiment detection at the level of entity, at the tweet level, and is evaluated on three Twitter datasets. The results confirm that the approach significantly outperforms the baselines in accuracy and F-measure for entity-level (neutral/polar) and polarity (positive/negative) sentiment detection.

According to (Schouten & Frasincar, 2016), sentiment analysis has received a lot of attention in recent years. The research conducted is focused on the aspect-level sentiment analysis aimed at finding and aggregating sentiment on entities mentioned in documents or aspects of them. Sentiment analysis provides very detailed sentiment information that can be useful for applications in various domains. A standardized evaluation methodology was used for quantitative evaluation of the proposed methods. The semantically rich concept level of sentiment analysis was identified as one of the most promising directions for future research.

As illustrated in this paper, sentiment analysis has been the topic of many research papers in the last few years. Over time, several sentiment measurement methods have been developed, including lexical and machine learning methods. Despite the tremendous interest in this area and the widespread popularity of some methods, it is not entirely clear which method provides the most

reliable results. The evaluation of the reliability of the methods was based on a benchmark of eighteen labelled datasets including messages posted on social media, movie, and product reviews, as well as opinions and comments in news articles. The results of the paper show the extent to which the predictive performance of the used methods varies (Ribeiro et al., 2016).

Zhang et al. (2018) review deep learning and provide a comprehensive overview of its current applications in sentiment analysis. Deep learning is used as a powerful machine learning technique that draws on multiple layers of data representation or features to further produce state-of-the-art prediction results. Deep learning has also been used in sentiment analysis in recent years.

Chen et al. (2017) state that different types of sentences express sentiment in very different ways. Focusing on traditional sentence-level sentiment classification research, the authors use a single-technique solution or focus on one special type of sentences. In this paper, the classification of sentences into different types is discussed and then sentiment analysis is performed separately on each type of sentences which tend to be more complex when they contain multiple sentiment targets. Based on these findings, a neural network based on a sequential model was proposed to classify sentiment sentences into three types according to the number of targets appearing in the text. The chosen approach was evaluated on four sentiment classification datasets and compared with a wide range of baselines. As a result of the experiment, it was confirmed that sentence type classification can improve the performance of sentence-level sentiment analysis, while the proposed approach achieves state-of-the-art results on several benchmark datasets.

Rezaeinia et al. (2019) considers sentiment analysis as a rapidly growing area of research in natural language processing (NLP) and text classification. Sentiment analysis technique is an essential part of many applications including politics, business, advertising, and marketing. There are various techniques of sentiment analysis, but recently, word embedding methods have been used for sentiment classification tasks. Word2Vec and GloVe methods are considered as one of the most accurate and applicable word embedding methods, but they do not consider the sentiment information of texts and need a large corpus of texts for training and generating accurate vectors. In this paper, a new method, Improved Word Vectors (IWV), was proposed to improve the accuracy of pre-trained word embedding in sentiment analysis. This method is based on part-of speech (POS) tagging techniques, lexicon-based approaches, word position algorithm and Word2Vec/GloVe methods. The results of the conducted experiments declare that the Improved Word Vectors (IWV) are very effective for sentiment analysis.

Yang et al. (2019) argue that sentiment analysis is to predict the sentiment polarity of specific targets in a specific text based on aspect. Previous research demonstrates considerable interest in modelling the target and context using the attention network. Using the average target vector to compute attention scores is considered unfair and very simple. Therefore, it is reasonable to further improve the mechanism. The authors proposed a coattention mechanism that alternatively models the target-level and context-level attention to subsequently focus on keywords of targets to produce a more effective representation of context. On this basis, a Coattention-LSTM network was implemented, which learns non-linear representations of context and target simultaneously, and can extract sentiment feature from the coating mechanism more efficiently. Another proposed network, Coattention-MemNet, uses a multiple-hops coattention mechanism. Extensive experiments on two public datasets demonstrate the effectiveness of all the proposed methods, and the findings provide new insights into the future development of using the attention mechanism and deep neural network for aspect-based sentiment analysis.

Ahmed et al. (2020) argue that sentiment dictionary has a great value to sentiment analysis, which is widely used in sentiment analysis compositionality. The polarity of sentiment and intensity of the word can vary from one domain to another. The authors present a novel approach to build domain-dependent

sentiment dictionary. First, a weak supervised neural model was proposed and trained on unlabelled data with weak supervision by reconstructing the input sentence representation from the resulting representation. Next, an attention-based LSTM was also proposed to solve the aspect-level sentiment analysis task based on the sentiment score obtained from the proposed dictionary. The experiments conducted on both English and Chinese benchmark datasets showed that compared to the state-of-the-art alternatives, the proposals of the authors can effectively improve polarity detection.

Wen et al. (2019) present a complete memristor-based long short-term memory (MLSTM) network hardware design solution. During the design process, the external and internal structures of long term memory (LSTM) were considered, both effectively implemented by memristor partitions. To minimize the hardware design scale, a parameter-sharing mechanism between LSTM cells was utilized by designing a circuit that requires only one memristor rung for each unit in an LSTM cell. The activation function of each unit is approximated in parts, which is designed with the given hardware. To validate the efficiency of the system, it was tested on IMDB and SemEval datasets, and word2vector encoding was used to encode the input data. The experimental results of the paper verify the effectiveness of the proposed MLSTM system. Based on the research conducted on the appropriate methods applicable in sentiment analysis, content analysis methods will be used to analyse the sentiment of the copper market, and then neural networks will be used to process the data for predicting the future development of the copper market sentiment, when LSTM is considered the best method to predict the required time series.

3 Material and Methods

The data for the analysis was collected through the social network Twitter-official site (2022). The research data pertained to one of the world's most prominent international mining companies, Freeport-McMoRan published for the period from January 1, 2020 to November 10, 2022. The research data for determining the copper market trends was taken from Investing.com (2022) for the period from January 1, 2020 to November 10, 2022. All the research questions formulated assume basic statistical and scientific description, comparison, and correlation analysis followed by regression analysis. The tools of formal logic, namely deduction, induction and generalization will be used to obtain answers to the research questions. Before the data processing, it is necessary to consider whether a relevant result will be achieved by using the data of the whole time series or only a part of it. Neural networks with the LSTM layer also include a forget gate; given the use of relatively recent data, it is assumed that the neural network result will not be biased by information from the beginning of the time series evolution (Vochozka et al., 2020). The answer to RQ1 will be based on the research data related to the copper market, specifically the copper price evolution over the entire 2020-2022 study period from Investing.com (2022), when the daily evolution of the copper price provides information on whether the price evolution is negative, positive, or neutral. The analysed data was further examined using the statistical methods mentioned above.

To find the answer to the research question RQ2, the entire time series for the period 2020-2022 will be used to analyse the sentiment of the relevant copper market, which is served by a major mining company. Freeport-McMoRan has been selected as the major mining company. The data collected from the social networking site Twitter-official site was analysed using a trained neural network on a classification task, with the output being information on whether the message was negative, positive, or neutral. The network primarily determines thresholds or probabilities and then selects the message with the highest probability as the output of the sentiment analysis. All the data collected will enter the sentiment analysis and will be examined by the neural network and then the sentiment will be classified. Artificial neural network ("NN") will be used, containing Long Short Term Memory ("LSTM") and consisting of a total of 9

layers, whereupon the result is the training set. Long-Short Term Memory Layer. The LSTM may be an individual NN. It is a sophisticated recurrent NN whose structure consists of four basic blocks: input gate, output gate, forget gate, and memory gate. Mathematica version 13 wolfram software, classify function was used for sentiment analysis.

The answer to research question RQ3 will be obtained by considering the answers to the previous two research questions. The development of the copper market development will be predicted on the basis of the developed sentiment analysis and then verified or refuted using Pearson correlation coefficient. Correlation coefficient measures the dependence between two variables. Pearson correlation coefficient is denoted r and its calculation is based on a bivariate random vector of magnitude n .

$$\begin{pmatrix} x_1 \\ y_1 \end{pmatrix}, \begin{pmatrix} x_2 \\ y_2 \end{pmatrix}, \dots, \begin{pmatrix} x_n \\ y_n \end{pmatrix}, \quad (1)$$

The following formula is used to calculate Pearson correlation coefficient:

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}} = \frac{\sum_{i=1}^n x_i y_i - n\bar{x}\bar{y}}{(n-1)s_x s_y} \quad (2)$$

where

\bar{x} and \bar{y} sample averages,
 s_x and s_y standard deviations,
 x and y random variables.

The resulting value will be graphically illustrated.

Next, the regression function will be used to describe the dependence of two or more quantitative variables in the form of a functional dependence. Due to the very large amount of the data, it was proceeded to average the monthly data in each year and subject them to examination using statistical indicators.

4 Results

The copper price trend in the 2020-2022 period provides answer to RQ1: The price of copper depends not only on supply and demand, but also on the overall global economy, the current dollar exchange rate and other factors that tend to cause volatility and fluctuations. Different economic, geopolitical, and technological factors affect the price of commodities positively or negatively, and since these price and market trends are inconsistent, they are very difficult to predict (Tapia Cortez et al., 2018).

Classical forecasting approaches have not proven very successful in recent years characterized by significant fluctuations in the prices of mineral resources such as copper; new approaches such as ARIMA allow accurate estimates of price changes (García & Kristjanpoller, 2019). Similarly, according to (HU & Won, 2018), the GARCH model, led to a low forecast horizon. due to price variations and subsequent forecasting performance capability.

The potential of using neural networks in the context of forecasting in chaotic copper price series, was examined by (Carrasco et al., 2018).

Neural network-based methods are considered the most reliable ones for predicting future copper price trends. When dealing with the development of the copper price achieved in the past period, proven statistical methods using Microsoft Excel software are applied.

Using statistical methods, the copper price trend was compared with sentiment analysis at the level of individual days. The resulting data is presented in Table 1, with the confidence level

in both cases being above 0.05, indicating that the normal distribution of the data analysed.

Table 1: Comparison of copper price development and sentiment analysis in the period under review

Real		Sentiment	
Mean value	0.0673901	Mean value	0.32726359
Error Wed values	0.0403808	Error Wed values	0.02652698
Median	0.0476190	Median	0.30769231
Modus	0.0000000	Modus	0.30000000
Standard deviation	0.2388962	Standard deviation	0.15693571
Variance of selection	0.0570714	Variance of selection	0.02462882
Pointiness	0.0072631	Pointiness	0.02387870
Skewness	0.5301559	Skewness	0.62428642
Max-min difference	0.9363636	Max-min difference	0.65178571
Minimum	-0.3000000	Minimum	0.06250000
Maximum	0.6363636	Maximum	0.71428571
Sum	2.3586545	Sum	11.45422557
Count	35.0000000	Count	35.00000000
Confidence level (95.0 %)	0.0820637	Confidence level (95.0 %)	0.05390930

The table shows the copper price development in comparison with development of sentiment. Figure 1 graphically illustrates the development of the entire time series (2020-2022) on a monthly basis, as the graph is not transparent when using a daily basis. The copper price and sentiment analysis are related, but as can be seen from the graph, the impact of market sentiment on the copper price shows some time lag.

Fig. 1. Evolution of copper lunar for the period 2020-2022

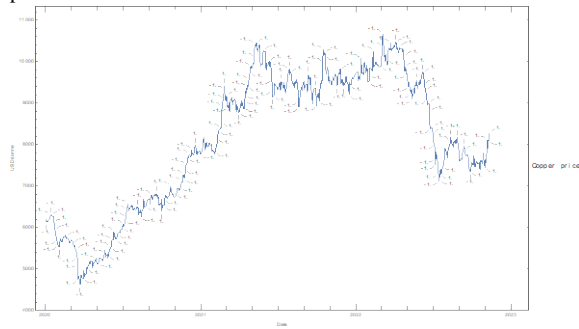


Performing sentiment analysis using neural networks provides the answer to research question RQ2: Yin et al. (2017) discussed the drawbacks of using a convolutional neural network utilized for sentiment analysis. The newly proposed lexically augmented convolutional neural network (SCNN) for sentiment analysis outperforms the baseline methods where it can better utilize the information found in sentiment analysis. S. Chen et al., (2018) state that with the development of social networks, sentiment analysis has become one of the most important research topics. LSTM deep neural network model is very often used. The authors propose a deep neural network model combining convolutional neural network and regional long short-term memory (CNN-RLSTM), which provides better performance compared to other neural network models.

Sentiment expresses a person's attitude, thoughts or expression triggered by a feeling. Sentiment analysis refers to the conversion of a text into a structured format when the problem in analysis is the insufficient number of labelled information. This problem can be eliminated by using a deep neural network (Moholkar et al., 2020).

Recently, people have been seeking opinions about products and services on their own, thus making opinions and sentiment analysis an everyday part of human activities. Wazery et al. (2018) use two main approaches for sentiment analysis, namely support vector machine, naive Bayes, decision tree and K-nearest neighbour machine learning approaches, and deep neural network, recurrent neural network using long short-term memory (LSTM). The results show that the recurrent neural network using LSTM achieves the highest accuracy (Wazery et al., 2018). Figure 2 shows the output of sentiment analysis using neural networks. The price trend is presented in the form of a text. According to the prediction, a slight decrease in the price of copper can be expected in the world markets in the near future.

Fig. 2. Sentiment analysis for the period 2020-2022 including prediction



The interdependence of copper price and sentiment analysis provides answer to RQ3: Measuring the dependence between random observations plays a crucial role in statistics. We are often interested in condensing the strength of the dependence into a single number, which is usually defined in the interval [-1,1] or [0,1]; such a number is called the correlation coefficient. The most commonly used correlation coefficient is Pearson correlation coefficient, which, for random variables X and Y with finite and positive variances, denotes the variance of Z through the covariance of X and Y and for any random variable Z. It has been confirmed that the converse implication of Pearson correlation coefficient is not true (Edelmann et al., 2021).

In a smart household of the twenty-first century, the ability to recognize everyday activities depends primarily on the strategy used to select appropriate features related to these activities. The selection strategy of daily activity features was based on Pearson's correlation coefficient. The experimental results demonstrate that the proposed approach provides higher recognition rates and achieves an average improvement in F-measure of 1.56 % and 2.7 %, respectively (Liu et al., 2020). Armstrong, (2019) investigated the use of Pearson correlation coefficient, arguing that it is important to focus on the non-linear relationship between two variables, on bivariate normal data, r (correlation coefficient) representing a significant portion of the variance (Y), outliers in the data, appropriate sample size, and the causality indicated by significant correlation. The problems and limitations of r imply a more cautious approach regarding its use, including the application of alternative methods.

From the regression analysis performed measuring the daily copper price in USD/tonne and the output of the sentiment analysis on a daily basis for the period 2020-2022, the coefficient of determination was 0.00188, suggesting that the sentiment in the copper market does not affect the copper price, but this may only be due to the time lag, as seen in Figure 1.

Tab. 2. Regression analysis

Multiple R	0.04339048
Reliability value R	0.00188273
Reliability set point R	-0.02836324
Erros Wed values	0.24226045
Observation	35.00000000

Tab. 3. ANOVA

	Difference	SS	MS	F	Significance
Return	1.00000000	0.00365331	0.00365331	0.06224739	0.80452497
Residues	33.00000000	1.93677410	0.05869012		
On the whole	34.00000000	1.94042740			

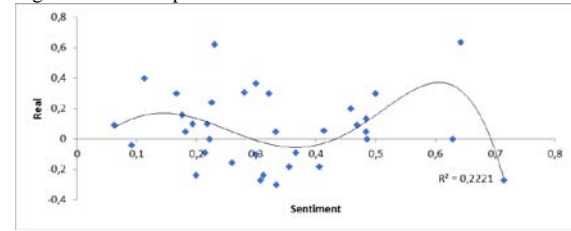
Tab. 4. statistical indicators of regression analysis

	Coefficients	Error Wed values	tStat	P-value	Bottom 95%	Top 95%	Bottom 95%	Top 95%
Boundary	0.08900634	0.095829894	0.92879514	0.35973965	0.1059610	0.28397374	0.10596104	0.28397374
Sentiment	0.066051377	0.264741049	0.24949427	0.80452497	0.60467109	0.47256833	0.60467109	0.47256833

The resulting regression equation from the regression analysis has the following form: $y = -0.06605x + 0.08901$. The correlation between the sentiment analysis and the copper

price is shown in Figure 3, where the best fit appears to be a sixth degree polynomial trend line with a reliability R2 value of 0.2221. The low value of this indicator points to an inverse relationship between the selected variables.

Fig. 3. Relationship between real and sentiment – trend link



The correlation coefficient between copper prices and sentiment analysis is calculated at -0.04339, which means that the two variables examined are not dependent on each other.

Tab. 5. Correlation between copper price and sentiment analysis

	Real	Sentiment
Real	1.00000	
Sentiment	-0.04339	1.00000

Due to the use of data on a daily basis, the set of analyzed data is very wide. Therefore, the development in individual months of the specific years under study is presented below. The years monitored are 2020, 2021 and almost the complete year of 2022 (excluding December). It shall be pointed out that in the case of the copper price, the data are for working days, but the sentiment analysis processes data for all days of the year.

Table 6 shows the average copper price and average sentiment analysis values for each month in 2020.

Tab. 6. Relationship between real and sentiment 2020

Month	Real	Sentiment
12	0.10000000	0.21875000
11	0.61904762	0.23076923
10	0.00000000	0.48571429
9	0.36363636	0.30000000
8	0.30000000	0.50000000
7	0.30434783	0.28000000
6	0.63636364	0.64285714
5	0.05263158	0.41379310
4	0.20000000	0.45833333
3	-0.27272727	0.71428571
2	0.00000000	0.62962963
1	-0.27272727	0.30769231

The data contained in Table 6 are graphically represented in Figure 4 below.

Fig. 4. Relationship between real and sentiment 2020 – trend link

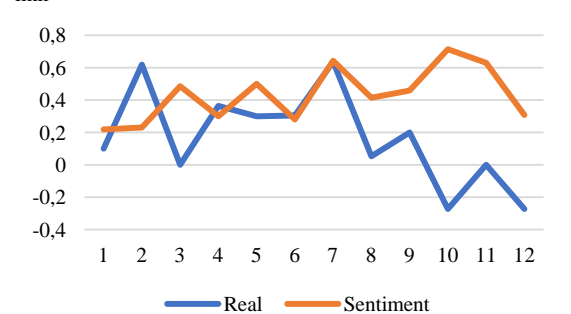


Table 7 shows the average copper price values and the average sentiment analysis values in each month of 2021.

Tab. 7. Comparison of the development of copper prices and sentiment analysis in 2021

Moon	Real	Sentiment
12	0.23809524	0.22580645
11	-0.09090909	0.36666667
10	0.04761905	0.48387097
9	-0.18181818	0.40625000
8	-0.23809524	0.31250000
7	0.09090909	0.46875000
6	-0.18181818	0.35483871
5	0.15789474	0.17647059
4	0.30000000	0.16666667
3	-0.04347826	0.09139785
2	0.40000000	0.11369048
1	0.10000000	0.19354839

The data from Table 7 are graphically represented in Figure 5.

Fig. 5. Relationship between real and sentiment 2021 – trend link

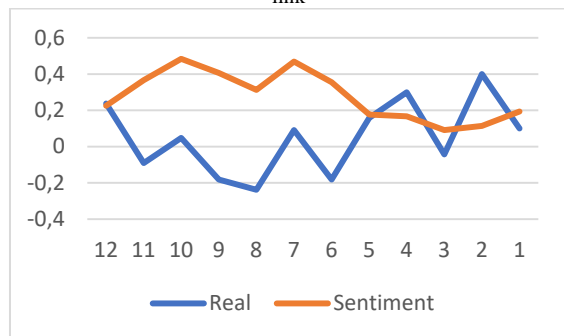


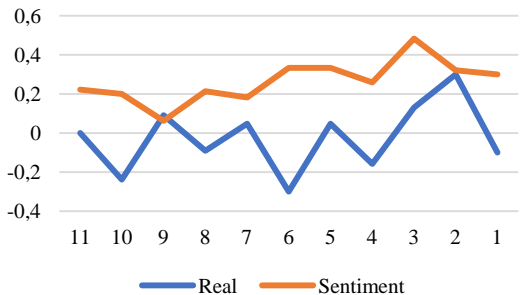
Table 8 shows the average copper price and average sentiment analysis values for each month of 2022.

Table 8. Comparison of copper price development and sentiment analysis in 2022

Moon	Real	Sentiment
11	0.00000000	0.22222222
10	-0.23809524	0.20000000
9	0.09090909	0.06250000
8	-0.09090909	0.21428571
7	0.04761905	0.18181818
6	-0.30000000	0.33333333
5	0.04761905	0.33322581
4	-0.15789474	0.25925926
3	0.13043478	0.48387097
2	0.30000000	0.32142857
1	-0.10000000	0.30000000

The data from Table 8 are graphically represented in Figure 6 below.

Fig. 6. Relationship between real and sentiment 2022– trend link



5 Discussion

5.1 RQ1: How has the copper market evolved over the past few years?

The answer to this research question and partial answers to RQ2 and RQ3nd three can be found in the individual sections of the presented results, where the copper price time series and sentiment analysis development in 2020-2022 and subsequently in each of the monitored years are graphically illustrated for better clarity; the tables show statistical data related to the copper price and sentiment analysis development. Based on the regression analysis performed comparing the daily copper price in USD/tonne and the output of the sentiment analysis on a daily basis for the period 2020-2022, the coefficient of determination was determined at 0.00188, indicating that the sentiment in the copper market does not affect the copper price, but this may be due to time lag only.

According to (Mendiola et al., 2022), copper is considered one of the most important minerals in the world. The authors decided to analyse the effect of changes in spot copper prices and futures on the stock returns of copper mining companies. Changes in copper prices turn out to have a greater impact on the stock returns of these mining companies traded in more developed markets than stocks traded in less developed markets.

Elshkaki et al., (2016) examined the demand, supply and energy implications associated with copper production over the period 2010-2050. Energy efficiency improvements in primary copper production would lead to a reduction in energy demand of 0.5% of the projected total global energy demand by 2050.

Taking into account the findings from the available literature and the results of the correlation coefficients of the indicators studied, it can be concluded that the sentiment of the copper market changes inversely proportional to copper price. This implies that copper price is influenced by the copper market sentiment, but with a considerable time lag. Based on this finding, the copper market sentiment can be predicted for the next decade on the basis of the current copper market price.

5.2 RQ2: What is the sentiment in the relevant copper market, which is served by a major mining company?

A sentiment analysis was focused on one of the world's most important international mining companies, Freeport-McMoRan. In the period 2020-2022, there was a significant fluctuating trend in copper market sentiment, but one that is relatively more stable compared to copper price. The development of the sentiment analysis over the period under review is presented in the calculation section, both numerically, in the form of tables, and graphically, using graphs. The correlation between the sentiment analysis and the copper price is shown in Chart 2, where the most appropriate trend line appears to be a sixth-degree polynomial trend line with a reliability R2 value of 0.2221.

According to (Siami-Namini et al., 2018), time series data forecasting techniques are not only important for economics. Deep learning-based algorithms such as LSTM outperform traditional algorithms such as ARIMA, showing a lower error rate compared to ARIMA. Based on these findings, it can be stated that LSTM is suitable for the commodity market and is considered the best method for predicting the required time series of copper prices.

Daily closing historical copper prices were investigated by (Vochozka et al., 2021) using artificial intelligence and recurrent neural networks (LSTM) with great potential for predicting the time series of copper price. With a longer time series, the question of whether to use the whole time series or only a part of it to obtain a relevant result remains. Neural networks use LSTM and forget-gate layers, but the result might be biased by information from the beginning of the time series and data (Vochozka et al., 2020). The data required for analysis and prediction was collected using the content analysis method.

The copper market sentiment follows the copper price trend with some lag. It is thus clear that the copper price affects the market sentiment indirectly, with other factors affecting the market sentiment also playing a role.

5.3 RQ3: What is the predicted development of the copper market in the future?

Based on the findings, it can be argued that the copper market sentiment will evolve indirectly depending on the copper price, but it is the copper price that increases its value in the minds of investors, thus improving the copper market sentiment.

Rising demand for copper will cause resource depletion, while saving resources and their more efficient use may delay their depletion. However, it is evident that a situation may arise where this required and scarce raw material will not be available for humanity (Castillo & Eggert, 2020). Harmsen et al. (2013) confirm an increasing demand for minerals in recent years mainly due to the developing global economy and higher product intensity.

Schipper et al. (2018) use regression and stock dynamics to develop copper models with demand estimates to 2100. Copper reserves are more or less constant and will be consumed gradually. Due to exponential mining and with the aim to satisfy the increasing demand, (Calvo et al., 2017) propose the possibility of using Hubert's model, which can identify the kinds of minerals that will become scarce in the next decades. The reaching of the so-called peak, however, will be considered a warning sign instead of indicating the depletion of these minerals.

The analysis of the individual years suggests that the market sentiment and the copper price almost coincide towards the end of the calendar year, but then diverge again at the beginning of the new calendar year and then converge again, with the curves crossing in some parts of the year. Considering the observed evolution in 2020-2022, a similar pattern could be seen for the years 2021 and 2022. The performed sentiment analysis using neural networks to describe the development of the copper price on world markets shows that in the near future, a slight decline in the copper price to the level recorded at the beginning of 2021, i.e., before the crisis related to the situation in Ukraine, can be expected.

6 Conclusions

The aim of the article was to explain the market development in terms of price and sentiment in the relevant market in the example of a major mining company and the global copper market. The experiment involved data collection, the application of descriptive statistics tools, and models based on artificial neural networks - NNS with an LSTM layer in the case of sentiment analysis. Regression analysis was used for the copper sales price data for the 2020-2022 trading days. Using neural networks and descriptive statistics tools, the evolution of market sentiment was analyzed and predicted as a function of the copper price, successfully answering all the research questions. The answers to the research questions were confronted with data from published academic articles, indicating that the sentiment of the copper market is indirectly influenced by the copper price as well as by other factors affecting customer perception.

After a detailed examination of copper market sentiment, we predicted the trend for 2023, concluding that the copper price in the coming months will be influenced by copper market sentiment like previous years with the inclusion of the effects of extraordinary events affecting the global economy. Singer (2017) found that copper demand is not driven by time, but predominantly by population size and income. Given the increase in world population, we can expect an increase in demand, which will result in earlier depletion of resources.

A sentiment analysis conducted by Freeport-McMoRan, one of the world's most important international mining companies over

the period 2020-2022 indicates a fluctuating development in the copper market sentiment. However, compared to the development of the copper price, this development is relatively more stable. Market sentiment will be more often influenced by social media sentiment, which is becoming an important indicator in the development of the price of more than just copper.

By conducting a sentiment analysis using neural networks in commitment to the development of the copper price on the world markets, it was concluded that the copper price in the near future will decline slightly to the level of early 2021, before the crisis related to the situation in Ukraine.

It can thus be concluded that the objective of the article has been met, which is confirmed by the results of the application section, showing similarities in the development of market sentiment and copper price in all the years under study.

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Primary Paper Section: A

Secondary Paper Section: AH, AJ

TEACHING UKRAINIAN AS FOREIGN LANGUAGE (TUKFL) AT PEDAGOGICAL UNIVERSITY: INNOVATIONS AND PERSPECTIVES

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Abstract: In this article, the authors have characterized the main directions of methodological search in teaching Ukrainian as a foreign language at the present stage; the experience of teaching this course at some Ukrainian institutions of higher education has been analyzed. The potential of teaching Ukrainian on the basis of the methodological approach / language skills / lexical topics has been specified in this paper. The authors have elucidated the criteria offered as indicative for designing textbooks and guidelines for teaching non-native speakers or foreigners. Particular attention is paid to factors that cause significant public response to learning and teaching Ukrainian considering the current geopolitical situation in Europe and in the world. The paper describes current trends in teaching Ukrainian and offers prospects for creating further methodological support.

Keywords: teaching Ukrainian as foreign language (TUKFL), methodological principle, language skill, competence, competitiveness.

1 Introduction

The intensive integration of Ukraine to the academic, scientific, and cultural discourses of the European society, establishment and promotion of humanistic values, understanding of their utmost weight and significance for upkeeping stability in Europe and the world in general, for preserving and transferring the ethnolinguistic-cultural heritage between the generations led to the Ukrainians reframing and understanding the Ukrainian language as the foundation of the centuries-old history of the Ukrainian nation, defining its specific linguamental code and the sources of the folk wisdom. Teaching Ukrainian as the first and state language in Ukraine opens prospects of reaching to the European scientific accomplishments for the native Ukrainian speakers and the Ukrainian citizens. Moreover, it is going to strengthen both the Ukrainian language itself and the European intercultural links.

Updating the content of the Methodology of Teaching the Modern Ukrainian Literary Language course contributes to the systematization of the lingual material on the synchronic and diachronic levels allowing to review and overhaul the school and university-level teaching content in the Ukrainian literature, history of Ukraine, and world history according to the modern requirements. It has facilitated the deeper study of the literary material, starting from the first samples of folk songs and up to the most modern works dealing with poignant social issues. The content of the world literature course has been overhauled as well showing the common traits shared by the Ukrainian and European cultural development and strengthening the interlingual, intercultural, and international cooperation. Furthermore, it empowers the Ukrainian Euro-integration endeavors.

The immediate motive force of overhauling and "rebooting" the methodologies and technologies of teaching the modern Ukrainian literary language in Ukraine in the last decade is the accumulated database of neuro-psycholinguistic, sociolinguistic, and TEFL research. This approach is reflected in the increased intensity of comparative lingual country-study research.

Additionally, it allows to extrapolate from the leading pedagogical experience improving the quality of teaching the first language inside the country. It should be noted that the status of English as a language of international communication in Ukraine will be regulated by the Law of Ukraine "On Using the English Language in Ukraine" (Law of Ukraine, 2023), with the relevant bill considered in the first reading of the Supreme Council of Ukraine (Government portal, 2023). It will undoubtedly accelerate the adoption of the European methodological approaches in the national practice enriching the Ukrainian methodology. Even more importantly, higher proficiency in English is going to motivate the methodology theorists and in-service teachers to publish their research in the field of the Ukrainian methodology in the scientific journals of the world getting the other academicians acquainted with the specificity of teaching Ukrainian as the first language at the Ukrainian educational institutions.

1.1 The topicality of the research

The increasing interest towards studying the Ukrainian language, ethnic and lingual culture by non-native speakers inside the country has led to allocation of a separate area of the methodological science – the methodology of teaching Ukrainian as a foreign language (Authors' note: hereinafter – TUKFL). Its emergence is caused by the modern challenges and the intensifying intercultural communication on the global level. Digitalization of the education process in general and the scientific discourse in particular has greatly increased the need for the existence of this academic discipline as the status of English as a language of international communication provides means for increasing the cooperation between methodologists in Ukraine and teachers of the Ukrainian language and literature in the world.

The war in Ukraine in 2022 and the forced migration of a considerable number of the Ukrainian school pupils / young people to the European countries have triggered the accelerated development and systematization of the methodological foundations of teaching Ukrainian both for native speakers and for speakers of other languages. Specific methodological approaches rely on 1) the official language of the country for relocation; 2) English as a language of international communication; 3) the local language typical for the location where the Ukrainian migrants may reside. A holistic methodological approach needs to be developed in order to organize the process of teaching the Ukrainian school students by the Ukrainian teachers abroad within the framework of «the Ukrainian school». Simultaneously, this course will serve as a roadmap for developing the methodological foundations of teaching Ukrainian as well as academic subjects in Ukrainian to speakers of other languages.

The above-mentioned factors can serve as a valid proof of the importance of establishing and developing the TUKFL course as it can safeguard the Ukrainian language from extinction, open its further linguistic potential and the literary heritage to the world, and highlight its longstanding links with the European humanitarian studies. That is why the issues of 1) "the survival" and further development of Ukrainian as the state language native for millions of citizens, and also 2) increasing its "attractiveness" for the foreigners studying Ukrainian have the unconventional priority in the national language policies which proves the topicality and novelty of these aspects of the research.

1.2 Problem stating and analysis of previous studies

Designing an integrated course of TUKFL as a separate academic subject relying on the methodology of teaching the modern Ukrainian literary language is going to be a response to the modern state of the Ukrainian education and a precondition for preserving Ukrainian for the next generations. Meanwhile, the

increase in the number of non-native speakers studying Ukrainian will result in broadening the linguistic repertoire and enriching the lexical stock. Cross-cultural communication and the resulting language interference, the introduction of innovative approaches to teaching different levels of the language all evoke a considerable interest of the Ukrainian methodologists during the last decade. Of no less importance is the need for adapting the techniques used in TEFL for teaching language skills towards the needs of TUKFL. Academics are worried of anglicisms permeating the lexical stock of the Ukrainian language, so effective techniques of working with the Ukrainian lexis are needed to preserve the authenticity of the language.

In the modern Ukrainian studies, Yuliia Laskava (Laskava, 2019) and Bohdana Puhach (Puhach, 2017) research the implementation of innovative techniques of teaching foreign languages. Liudmyla Bereza (Bereza et al., 2021) is exploring the specificity of non-native speakers studying Ukrainian. The interaction of linguistics and methodology in teaching the Ukrainian grammar is the focus of Zoriana Matsiuk studies. Lesia Nazarevych (Nazarevych et al., 2020) gives an insight into the theoretical background and practice of teaching Ukrainian as a foreign language using the experience of her Ukrainian university.

The potential of distance learning platforms and methods of their usage at secondary schools and universities of Ukraine is being researched in depth in the recent years. Considering the spread of COVID-19 epidemic in the world and other security risks in Ukraine starting from 2022, detailed methodological recommendations for using ICT for language learning can be regarded as an immediate response for the current challenges: Mariia Bilianska (Bilianska et al., 2021), Lesia Nazarevych (Nazarevych & Nazarevych, 2018), Alla Kulichenko (Levchenko et al., 2022), and Mykhailo Rakhno (Rakhno & Shramko, 2021) research relevant mechanisms of distance learning. Hanna Onkovych (Onkovych et al., 2022) studies the didactic potential of webinars for raising the professional level of language methodology specialists.

Oksana Trumko (Trumko & Horda, 2022) and Iryna Dyrda (Dyrda, 2015) are developing productive approaches towards teaching Ukrainian as a foreign language, while Mariia Tsurkan (Tsurkan, 2019) is using the genre approach to teaching languages at medical universities.

It should be noted that skill-based teaching of UkFL has not fully been elucidated in the academic discourse yet, but Halyna Matsiuk (Matsiuk, 2021) is working on some aspects in this area.

The logical outcome of this research should be the design of a complex textbook or methodological guidelines which include techniques and methods of teaching Ukrainian as a foreign language. For instance, Halyna Temnyk and Olha Soroka (Temnyk & Soroka, 2020) have created a textbook based on the country-study approach, and Lesia Nazarevych and Natalia Havdyda (Nazarevych & Havdyda, 2017) are using the multi-level approach to teaching UkFL.

The aim of this paper is to outline the modern techniques and approaches to teaching Ukrainian at a pedagogical university and the critical analysis of their methodological potential for TUKFL. Full implementation of this aim requires solving a range of tasks including a) showing the most topical approaches to teaching Ukrainian at the Ukrainian universities; b) describing the use of different teaching techniques in the online mode required by the quarantine restrictions, and later – by the martial law (starting from 24.02.2022); c) offering prospective methods and techniques of teaching Ukrainian as a foreign language using the achievements of TEFL methodology and considering the realities of life in Ukraine.

2 Materials and Methods

The research is based on the content monitoring method, which allowed to a) select and describe traditional methods of teaching Ukrainian at a pedagogical university; b) to research the competence approach as a background for training a professional linguist (teacher/translator/interpreter). The comparative method is used to highlight the upsides of techniques and technologies in active use at institutions of higher education and to study the range of ICT for teaching Ukrainian online. Content analysis has allowed choosing the selection criteria for the teaching material and types of tasks aimed at forming specific language skills according to TEFL guidelines. Content analysis also lets analyze the modern interactive methods of teaching Ukrainian. The psychological state of the speaker has been studied using the method of psychological experiment, which includes online poll and gradual scaling method of ranging the answers according to language levels, their pragmatic load, and communication skills. The poll conducted within the framework of the study has included 100 students of the first (Bachelor's), the second (Master's) and the third (Doctor of Philosophy) levels of higher education who study Ukrainian as the first language, and 10 foreign students at the pedagogical university. The active stage of the poll took place in 2022-2023, with the results processed from August till October, 2023.

3 Results and Discussions

The increasing demands to the quality of education and the level of professional training of the Ukrainian university graduate aimed at raising their competitiveness in the Ukrainian and international job market have led to overhauling the entire range of academic disciplines. Meanwhile, the demand to build the professional career in the multilingual and multicultural environment has caused the critical review and updates of the professional competences of the student – an intending linguist teacher within the framework of educational-professional and educational-scientific programs.

Competence approach. Nowadays, the competence approach is the basis for the modern humanitarian training of the student at the Ukrainian pedagogical university as it allows forming the deep theoretical background and teaching practical skills based on the ability of the student to react to changing learning conditions which can further help the student to adapt flexibly to challenges in the professional team. Among the range of important professional traits, the linguacultural competence possesses a special significance, and its development has become especially topical on the edge of the 20th and the 21st centuries. Learning the language is impossible without immersion to the national culture and acquaintance with the national conceptual and lingual worldview, self-identification, cultural icons, and lingual concepts. Improving this competence in the course of methodology of teaching Ukrainian as the state (first) language allows systematizing the nationally-marked structures already known from the childhood, ascertaining their connotation and cases of usage, while the work on this competence within the TUKFL course elucidates the unique nature of the nationally-specific language constructs explaining their etymology to non-native speaker of Ukrainian and foreigners from the perspective of the Ukrainian-European cultural and art interaction and facilitating barrier-free communication in a multicultural professional team.

The digital competence of the graduate of the pedagogical university (the language teacher) is also significant as it provides the possibility of selecting / creating author's multimedia content of country-study and sociocultural nature aimed at teaching the realia of the Ukrainian lingual culture in the distance / blended learning mode including distance learners studying UkFL from abroad. The digital competence of the student includes skills of using the already known information technology instruments and mastering new ones for using the language material on the basis of a) English as a medium; b) native language in case of the common background.

The communicative approach to teaching Ukrainian as a foreign language in close unity with the above-mentioned competences shows a high level of effectiveness. Their complex application allows the student to master the learning material at a deeper level, while simultaneously raising the motivation towards learning Ukrainian. The communicative approach “places the use of language and its functions at the centre of the theory and practice of teaching the second language”, and is subsequently oriented at “the functional criterion of selection and presentation of the language material, its situation- and topic-driven teaching, study of lexis and morphology on the syntactic basis” (Shelest, 2018). A set of communicative tasks with elements of comparative analysis (Ukrainian ↔ English / Ukrainian ↔ L₁) allows to differentiate between and master the language structures and country-study units (the fund of paremies). As an example, we take this task (the beginner’s level, the lexical topic “Seasons. Weather”): choose 5–7 folk beliefs related to seasons (weather) in English (or the first language), analyze the present nationally-marked lexemes, and explain the semantic differences using the national traditions as a background. (The intermediate level, the lexical topic “Traits of character”): choose one or two traits of character and provide 3-5 synonymous adjectives for describing these traits in Ukrainian and English (the first language), explain the differences. (The proficiency level, the lexical topic “Traits of character”): find 5-7 proverbs / phraseological units to mark the traits of the human character (using the names of animals, plants, or inanimate objects if available) in Ukrainian and English (the first language), explain the differences in their interpretation; (the proficiency level, the lexical topic “National symbols and icons”): create a presentation based on the National list of elements of non-material cultural heritage of Ukraine / non-material heritage of UNESCO (3–5 elements of the student’s choice), provide a short historical background, present 3-5 cultural icons of the English culture (or the culture of the country of the first language), show their historical background, and explain similar and different features (if available); (the proficiency level, the lexical topic “Picturesque landscapes of the country”): create a presentation (if possible – a video review) of 5-7 iconic sites of Ukraine / the United Kingdom (or native locations of the student), characterize their cultural significance using nationally-marked lexical and syntactic units; (the proficiency level, the lexical topic “National Character / Linguacultural Types”): create a description of the Ukrainian national character (2-3 prominent linguacultural types) using the nationally-specific expressions and nationally-marked syntactic structures, outline their strong and weak points, compare them with the description of the national character of the English (first) language.

Ukrainian for Professional Purposes. Another topical issue within the framework of teaching Ukrainian as a foreign language is teaching Ukrainian for professional purposes which correlates with the CLIL methodology in TEFL. The integration of essential language units with the subject content accelerates the process of learning Ukrainian as it allows the students to get acquainted with the Ukrainian professional terminology and ways of coining terms as well as to review the international equivalents using English and the first language. Thus, it provides knowledge and teaches skills needed for effective work in a multilingual team. Using the methodology of integrated content and language learning on the national Ukrainian background hones the student’s skills of critical analysis providing the interlinguistic parallels between word-building (the analysis of language material), lexical meaning of the terms (semantic features) and its syntactic valence / context (the analysis of the formal grammatical level of the sentence) in Ukrainian / English / the first language. The following lexical topics of the discipline have special significance: “Contributions of the leading figures of the Ukrainian language towards the development of the literary language” (Work of I. P. Kotliarevskyi, T. H. Shevchenko, I. Ya. Franko at establishing the language norms); “Communicative features of speaking / Communicative professiogramme of the speaker” (creating a portfolio of communicative traits of a speaker in a specific field, the analysis of types of dictionaries to be used in a multilingual team for zero-barrier communication); “Public

speaking” (the analysis of pragmatics of a specific discourse, mainly the academic, scientific, and publicist ones, learning the maxims and principles of communication, specific features of using them in the organization of public speaking, the review of the paradigm of the national language formulas, linguistic taboos, specificity of using euphemisms, jargon at the state “Ability to ask questions / ability to answer the questions relevant to the topic of the report”; studying the national communicative etiquette, the history of public speaking in Ukraine, the prominent speakers of the past); “Translation of professional terminology” (analyzing the relevant Ukrainian lexemes in a specific professional field and their contextual combinations, reviewing the most significant terminological dictionaries of Ukrainian). Successful internalization of this material provides a solid foundation for in-depth studies of literary Ukrainian as a foreign language.

Lingual-ecological approach. Intensive contacts of Ukrainian with English during the last two decades have resulted in a considerable influx of lexical units in Ukrainian from the topic fields “ICT”, “Food / Drinks”, “Art”, “Sport”, “Social Science”, “Medicine”, etc. Rapid integration of these lexemes to Ukrainian has been caused by a range of factors, the most important ones being a) the development of global tourism and, subsequently, the contacts with other languages and cultures, their “discovery” by the Ukrainians; b) the lack of available equivalents for certain life realia previously unknown to the wide audience in Ukraine; c) COVID-19 epidemic in Ukraine and the resulting acute need for implementation of the university online platforms, using Internet services for distance learning; d) the issue of “language fashion” and the youth slang among teenagers and subcultures when an anglicism, due to its novelty and “attractiveness” replaces its Ukrainian equivalent. The qualitative indicators of borrowings are on the increase, while “the expansion of anglicisms in Ukrainian during the first two decades of the 21st century creates a negative language situation which we deem to be socially dangerous and one causing lingual-ecological disruption and contributing to the increasing verbal aggression” (Shynkar et al., 2022). Considering the above-mentioned trends, a well-balanced response to these dangers for preservation of the authentic lexical stock can be the use of lingual-ecological approach. This approach requires using the lexical fund of the language during the study of each structural level of Ukrainian. It is also topical for teaching language skills in Ukrainian. The following typical exercises can be offered for working with the lexis: (the beginner’s level, the lexical topic “Seasons. Weather”): choose 3-5 synonyms for weather conditions (for instance, *zaviriukha* ‘blizzard’, *vikhola* ‘snowstorm’, *khurdelytsia* ‘winter storm’) in Ukrainian, offer their equivalents in English (the first language) if such are available, explain the differences in semantics; (the beginner’s level, the lexical topic “Garden. Vegetables and Fruits”): choose 5-7 names of fruits and vegetables, name the Ukrainian dishes which can be cooked using them, find their equivalents in English (or the first language), provide the recipe for the favorite dish using these lexical units (if available); (the intermediate level, the lexical topics “Inspiring Fairy-Tale Characters”): describe 2-3 characters of the Ukrainian folk tales whose actions can serve as a role model, explain your motivation for the choice using the authentic lexemes in Ukrainian, find equivalent characters in the English fairy-tales (or fairy tales in the first language of the student), trace the parallels; (the proficiency level, the lexical topic “National Heroes”): offer 3-5 iconic names embodying Ukraine, its national spirit using the authentic lexis, provide their equivalents from the English (national) culture, compare them; (the proficiency level, the lexical topic “Professional Terminology”): select 5-7 professional terms in Ukrainian, find their equivalents in English (the first language), trace the cross-language parallels and the etymology of the units (if available).

Neuro-linguistic programming. In the early 21st century, the NLP methodology is one of innovative approaches which allows generating the internal psychological links and stable motivation towards studying Ukrainian by non-native speakers. The implementation of elements of this methodology in lessons allows focusing the attention on key words of the content block,

forming the positive attitude towards them while the analysis of cultural historical constants and the work with the axiological axis (within the framework of lexical topics “Inspiring Fairy-Tale Characters” and “National Heroes” it can be the axis “protagonist – antagonist”, the description of circumstances which made these characters into heroes; while working on the topic “Seasons. Weather” it can be the axis “Weather favorable for living / growing the harvest – weather dangerous for living”, etc.) can be useful for comparative analysis of life realia, the exchange of subjective experience by the participants of the learning process honing their soft skills and ensuring fruitful communication in the academic group or the professional team (Puhach, 2017). In particular, Maria Tsurkan (Tsurkan et al., 2020) studies the importance of the emotional approach in teaching Ukrainian as a foreign language (Tsurkan et al., 2020).

Methodology of synchronous and asynchronous learning. During the last five years, the implementation of blended learning technologies at the Ukrainian institutions of higher education has opened the prospects of teaching Ukrainian as a foreign language using ICT. The learning content can be studied at the time suitable for the student, while the communicative skills can be developed in the form of Zoom / GoogleMeet-conferences or colloquiums analyzing the personal content created by students (a video recording of a monologue on a specific topic, a video recording of public speaking – a report at a virtual / Internet conference with a presentation, etc.), project group work. Nowadays, the work with these online virtual services provides the most opportunities for the individual educational trajectory of the student ensuring the subjective approach in mastering the language material.

Interactive technologies in teaching Ukrainian as a foreign language. Among the innovative technologies of teaching Ukrainian as L₂, gamification has acquired a significant popularity as an instrument of properly engaging all the members of the academic group in doing tasks in a relaxed atmosphere or facilitating the exchange of experience during the academic interaction. Using gamification in mini-groups or in an academic group is a key to reducing stress caused by learning the new material and powerful means of forming the positive motivation towards communication with other participants (as an NLP component).

Coaching is a productive method of individual or mini-group learning of Ukrainian as a foreign language when the learning of content becomes a subjective responsibility of the student. The implementation of this technology at the Ukrainian universities is done through the completion of individual / creative tasks using the teacher as an adviser and doing a practical course of Ukrainian as a foreign language. This approach optimizes the learning process in terms of time and efforts contributed by the student.

In order to ascertain the potential difficulties in learning Ukrainian as a foreign language, the following questionnaire has been created (Figure 1), where the participants are offered the following questions:

- Which approach to learning Ukrainian is easier for you:
 - formal grammatical (learning the rule – practicing in communication);
 - communicative (communication in which you learn the rules indirectly);
 - immersion (language intensive; NLP, etc.);
 - other (provide your own answer).
- If you learned Ukrainian as a foreign language, which level of the language system would you consider the hardest to master?
 - phonetic;
 - word stress;
 - lexical;
 - morphological.

The following questions aim to detect the presence of positive motivation or to outline the lexical topics most favorable for communication:

3. What makes you feel that your level of language proficiency in Ukrainian (as a foreign language) is increasing?

- I understand audiovisual content better (songs, movies with / without subtitles, audio/video blogs);
- I can understand information content in the city (street signs, advertisement, billboards, etc.);
- I can speak more fluently (in academic and everyday situational environments): I choose synonyms quicker, can use phrasal expressions or idioms, can paraphrase);
- I start to understand the context and implicit information in speech / texts.

4. Which topic(s) is/are the easiest for you to communicate in Ukrainian?

- personal, hobbies, self-development;
- official and business communication, academic communication;
- culture;
- art and literature.

This question determines the probability of using the intermediary language in teaching Ukrainian as a foreign language:

5. Do you use any other Slavonic / non-Slavonic language as an intermediate while learning Ukrainian?

- no;
- yes.

This question studies the proximity of teaching Ukrainian / English as a foreign language in language skills:

6. Do you deem it necessary to introduce formal levels of proficiency in Ukrainian as a foreign language (A₁-C₂) with detailed description of four language skills?

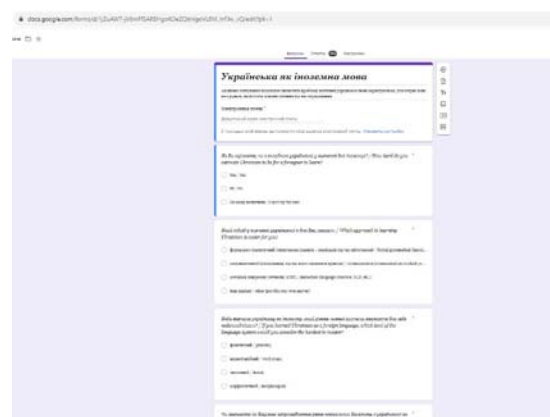
- yes, it would be useful for objective assessment of achievements;
- no, for Ukrainian it is not necessary;
- yes, foreign students should have clear levels of learning achievements presented to them;
- no, it is possible to use the already existing scale for English as a Foreign Language.

The issue of oversaturation of Ukrainian with borrowed lexemes and the attitudes to it are revealed by this question:

7. What is your attitude to words of foreign origin in Ukrainian (for instance, anglicisms)?

- positive, it makes communication with foreigners easier;
- negative, they encumber the Ukrainian language;
- positive, they enrich the language;
- negative, they are just a fleeting fad.

Figure 1 “Ukrainian as a foreign language”



Note: own questionnaire has been managed specifically for the research

The poll results show that 72,8% of the respondents studying Ukrainian as a state language regard it as difficult for non-native speakers. 61,2% of participants state that the communicative approach is the easiest one for a potential learner of Ukrainian as a foreign language. 36,9% of the respondents state that the morphological level of the Ukrainian language structure is difficult for learners, while 35% regard the phonetic level as difficult. 54,4% of participants believe that the introduction of levels of learning achievements (A₁-C₂) from the beginner to proficiency is going to be a positive development. 79,6% of the respondents use the oral form of Ukrainian most often, with 67% of them regarding personal, hobbies, and self-development as the easiest topics for communication. The attitude of the students towards the lexical borrowings (primarily, anglicisms) provides interesting results as 54,4% of the respondents regard the borrowings as a positive phenomenon enriching the lexical fund.

4 Conclusions

The current situation in Ukraine and intensive digitalization of the learning process have caused the increase in interest towards teaching Ukrainian as a foreign language to non-native speakers and foreigners which is going to contribute to the European integration aspirations of Ukraine and to provide strong links between the Ukrainian language and literary heritage and the European cultural and historical achievements. The need for updating the course of the methodology of teaching the modern literary Ukrainian language is currently caused by the necessity of ensuring effective teaching Ukrainian as the first (state, native) language to the Ukrainian children and youth forced to go abroad starting from 24.02.2022. Of no lesser importance is the search for optimal criteria of creating a textbook in methodology of teaching Ukrainian as a foreign language at a pedagogical university in Ukraine.

To sum up, this paper does not cover the entire range of questions raised about the effective methods, methodologies, and techniques of teaching Ukrainian as a foreign language opening further prospects for researching the interactive technologies for the TUKFL course.

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Primary Paper Section: A

Secondary Paper Section: AM

PRICE DEVELOPMENT OF WHEAT AND RAPESEED

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Abstract: The objective of the paper was to analyse the 2017-2022 time period using chronologically ordered time series with information on wheat and rapeseed prices. To assess the price development in the period under study, possible trends and seasonality. Furthermore, to confirm or refute dependence of agricultural commodity prices on the COVID-19 pandemic using correlation method. Three research questions were formulated and answered through these scientific methods. Descriptive analysis was used to process the chronologically ordered time series, graphs were used for visualization. Statistical indicators for mathematical expression such as mean, median, minimum and maximum were identified. In order to determine trend or seasonality, a trend line was plotted on graphs showing no statistically significant indicator which would confirm this. Correlation analysis showed low linear dependence between commodity prices and extreme events such as COVID-19.

Keywords: Wheat, rapeseed, descriptive analysis, correlation method, graph

1 Introduction

Volatility of commodity prices in the market is rising. Jankvic, Kovacevic, Jelocnik (2020) examine forecasts of future wheat price behaviour and make timely decisions on an appropriate price risk hedging strategy. There are many factors that can affect the price of wheat and rapeseed, including supply and demand, seasonal changes in production, news events, currency fluctuations and changes in trade policies. In recent years, world events such as the Covid-19 pandemic and the Russia-Ukraine war have also affected commodity prices.

The social demand for wheat is great. Wheat grain is used in the food industry and is a basic raw material for making bread, pasta and in confectionery. The main use of oilseed rape is in the production of a biobased component blended into diesel fuel. This product is called RME (rapeseed methyl ester). Rapeseed is one of the oldest and most widespread economic crops in the Czech Republic. Cultivation of rapeseed is very profitable for agricultural producers. These consequences are linked to the significant increase in rapeseed cultivation in response to increasing market demand.

Subsidies are one of the important factors influencing commodity prices. In the Czech Republic, farmers are governed by the State Agricultural Investment Fund (SAIF), an accredited paying agency that helps them to broker financial support from the European Union and national sources. Globally, however, subsidies are influenced by the Paris Agreement, which aims for a widespread transition to sustainability. In order to actually achieve these goals, subsidies can be introduced. Agriculture can benefit the climate and biodiversity, but it can also harm them. Agriculture therefore has an important role to play in the global transition to sustainability. Some agricultural resources appear to be environmentally friendly, but most appear to be ecologically destructive. Results show that agricultural subsidies must be substantially reduced and implemented more as complementary. Policy instruments such as quantity control instruments seem to be much more effective (Heyl et al. 2022)

World commodity markets are currently particularly unstable due to major health crises, political tensions, sanctions, rising demand and other global supply and demand factors. However, it should be noted that the volatility of world wheat prices has recently increased (Krasnovskiy et al. 2022). In addition to macro-environmental factors that determine prices, agricultural and other commodity markets are increasingly vulnerable to ever-increasing speculation on major commodity exchanges (Staugaitis and Vaznonis, 2022). One of the best-known commodity exchanges is the French Matif exchange that has a major influence on the price of agricultural commodities.

Imports of grain and oilseeds from Ukraine were 78.2 percent lower between February and July 2022. This was due to the Russia-Ukraine war. North America and Europe have benefited most from this trade diversion. The war has had a substantial impact on the countries directly involved in trade, but only a limited impact on global grain and oilseed markets in terms of quantities traded (Ahn, Kim, and Steinbach, 2023). There are many ways in which commodity prices can be predicted. Cariappa et al. (2020) forecasts prices based on the ARIMA model in countries with higher wheat production. Umar, Jareno a Escribano (2021) examined the joint and bivariate dependence of returns and volatility between different agricultural commodities and oil price shocks. Khan, Sharma a Ahmed (2022) model the dynamics of oil and agricultural commodity price linkages in linear and non-linear frameworks. Policy responses to Covid-19 that could have significantly affected the agricultural commodity market included, for instance, export restrictions, reduced consumption stocks or oil prices. Empirical analysis results suggest that the oil price decline may have contributed to the stability of the world grain market in the early 2020s, despite concerns that the supply chain would be disrupted. Export restrictions could significantly increase global prices, and such restrictions could also affect target commodities (Gutierrez, Pierre, and Sabbagh, 2022).

Energy is a significant part of production costs for a number of agricultural commodities. Previous studies have shown an intertwined relationship between oil prices and agricultural commodity prices, a relationship that may influence decision making of agricultural entities. Strong evidence of heterogeneity across time horizons and commodities has been found (Lundberg et al. 2021).

The aim of this paper is to assess how wheat and rapeseed prices have been affected by Covid-19 and the Russia-Ukraine war, to determine how volatile the prices are over the specified period (2017-2022) and whether prices vary according to seasonality and trends. Thus, the following research questions were formulated:

Question 1 (RQ1): How did the price of wheat and rapeseed develop between 2017 and 2022?

Question 2 (RQ2): How does seasonality affect the price of wheat and rapeseed?

Question 3 (RQ3): How have the events of Covid-19 and the Russia-Ukraine war affected the price of wheat and rapeseed?

2 Literary research

Information concerning the relationship between the cost of production and the market price of wheat allows farmers to predict the market price trend and reduce business risks in the farm. They will decide whether to sell before harvest, immediately after harvest or store the wheat and sell it later. If the market price of wheat reaches the level of operating costs, farmers will stop selling and store their products in anticipation of higher prices in the near future. The results of the analysis indicate a strong positive correlation between operating costs and the market price of wheat. This indicator makes it possible to predict the future behaviour of the wheat price and timely determine on an appropriate price risk hedging strategy (Jankovic, Kovacevic, Jelocnik, 2020). Jankovic, Kovacevic, Jelocnik (2020) study the prediction of future wheat price behaviour to decide on an appropriate price risk hedging strategy in a timely manner. Umar, Jareno, and Escribano (2021) studied the joint and bivariate dependence of returns and volatility between different agricultural commodities and oil price shocks. They propose to use a vector autoregression methodology with fresh time-varying parameters (TVP-VAR). In addition, they pay special attention to the most important periods of economic turbulence in the last 20 years such as the dot-com bubble, the global financial crisis, and the COVID-19 pandemic crisis. The main results show the directional interdependency of returns and

volatility for crude oil risk shocks is higher than that for crude oil demand shocks and, conversely higher than that for crude oil supply shocks. The overall link between returns and volatility varies over time and increases during periods of economic crisis. Khan, Sharma and Ahmed (2022) modelled the dynamics of crude oil and agricultural commodity price links in linear and non-linear frameworks.

Advanced econometric approaches, namely autoregressive distributed lag and nonlinear autoregressive distributed lag models, were used for symmetric and asymmetric impacts of crude oil prices on agricultural commodity prices. The results show that in the aggregate analysis, crude oil prices have an asymmetric impact on 10 groups of agricultural commodities in the long run while the disaggregated analysis shows that crude oil prices have a long-term positive elasticity of 29 out of 37 agricultural commodity prices.

An empirical assessment was provided for the impact of volatility of the world's agricultural commodity price indices on economic processes in industrialized countries (the United States and the European Union countries). The results showed a positive dependence of the US GDP trend on the growth of worldwide prices of raw materials. A similar result was obtained for the industrial production indicators in both countries under review. In the evaluation of the agricultural raw materials in the world's commodity market, the prices of sugar and rice were identified to fluctuate the most. However, it should be noted that the volatility of world prices of wheat has recently increased (Krasnovskiy et al. 2022). Staugaitis and Vaznonis (2022) analyzed the impact of financial speculation on agricultural and other commodity prices and volatility of returns. They use daily returns on wheat, soybeans, corn, and oats from the Chicago Mercantile Exchange as well as two other commodities (crude oil and gold) to compare the magnitude of this effect. In addition to traditional time series analysis tools, they use the threshold generalized autoregressive conditional heteroskedasticity (TGARCH) technique to measure this effect. They also present a model using seasonal dummy variables to see whether the financial speculation effect on returns volatility varies across seasons as seasonality plays an important role in returns dynamics for agriculture. They concluded that either there is no relationship between the increase in short-term speculation and agricultural commodity price volatility or the relationship is at best questionable.

An attempt has been made to forecast monthly wholesale prices of wheat using the ARIMA model in spatially separated markets in India using historical data. The prices of wheat exhibited a distinct seasonality captured through monthly price indices. It was identified that prices were highest in the harvest season and lowest in the post-harvest season. The forecast prices estimated by the ARIMA model are higher in countries with low or negligible wheat production and lower in countries with higher wheat production. The predictive performance of the models was further supported by measures such as RMSE, MAPE and MAE with 95% confidence intervals (Cariappa et al. 2020).

Ayyildiz (2022) studied how concerns about the COVID-19 pandemic had affected grain prices globally. The global fear index (GFI) and sub-price indices were used to identify the impact of COVID-19 induced fear on grain prices. Considering an asymmetric relationship between the variables, a non-linear model with a distributed autoregressive lag was used to determine this relationship. The model results show that in the long run, the agricultural commodity prices responded to positive (negative) effects in the GFI by price increase (decrease) and that the effect of a GFI increase on agricultural commodity prices was greater than the effect of a GFI decrease.

For the purpose of the paper, the time series analysis was chosen, namely descriptive time series analysis for research questions 1 and 2. This analysis will allow to monitor and follow price changes over time, fluctuations in the time series and possible trends. Correlation analysis was chosen for research question 3. Document content analysis will be used to collect

secondary data for all research questions. Visual analysis (graph) was chosen to ensure a perspicuous representation.

3 Data and methods

Data collection methods

Considering the first research question and the second research question, information on wheat and rapeseed prices in the 2017-2022 period will be used from www.kurzy.cz (Kurzy.cz, 2023) for wheat data collection, and www.eagri.cz (Eagri.cz, 2023) for rapeseed data collection. The average monthly price figures of both agricultural commodities in CZK per 1 tonne will be applied. They are included in Annex 1.

As for the third research question, data on the increments of COVID-19 positive patients will be used for the period under review, while the pandemic did not break out until 2020, so the period before will be supplemented with zero values. Specifically, the average monthly increments will be monitored on the basis of data taken from the "Onemocnění aktuálně" website, which is the official website of the Ministry of Health of the Czech Republic (MOH, 2023). The data are included in Annex 2 table.

Data processing methods

In relation to the first research question and the second research question, the data will be processed in Microsoft Excel 2013. Descriptive analysis will be used to process chronologically ordered time series with information on wheat and rapeseed prices. A graph will be used for visual representation. Statistical indicators for mathematical expression such as mean, median, minimum and maximum will be used to obtain the mean of variability and range of the data. A graph will be plotted using a curve in order to show whether seasonality affects the price of wheat and rapeseed and to answer the second research question.

As regards the third research question, correlation method will be used to determine whether there is a statistically significant relationship between development of agricultural commodity prices and the Covid-19 pandemic. The CORREL function will be used to calculate the correlation coefficient ranging from -1 to 1. A value of 0 means that there is no linear dependence between the variables. A positive value of 1 means that there is direct functional linear dependence between the variables, with one variable increasing and the other one increasing as well. A negative value of 1 (i.e. -1) means that there is indirect functional linear dependence between the variables, with one variable increasing and yet the other one decreasing. The closer the value of the correlation coefficient is to one or minus one, the stronger the relationship is. Values around zero mean that the values have no relationship.

Next, there will be a comparison of the test statistic using the correlation coefficient and the amount of data with the so-called critical value. A significance level of 5% will be considered and looked up in the Student's distribution of tables.

The test statistic will be calculated according to the following where r is the correlation coefficient value and n is the number of values (Neubauer, Sedlačík and Kříž, 2016).

In relation to the third research question, the following hypothesis is stated:

H0: Extreme events affect the price of wheat and rapeseed.

H1: Extreme events do not affect the price of wheat and rapeseed.

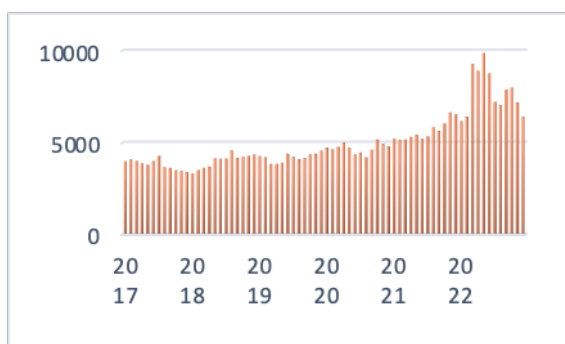
Having applied the selected methods, the following results are expected: Statistical description of the time series of wheat and rapeseed prices. Graphical representation of the development of wheat and rapeseed prices. Statistical description of the time series of agricultural commodity prices depending on seasonality. Graphical representation of the development of agricultural commodity prices depending on seasonality. The degree of correlation between agricultural commodity prices and the Covid-19 pandemic incidence.

The expected results are as follows:

According to the processed data, the prices of wheat and rapeseed for the 2017 – 2022 period will be found. Owing to the methods used, it will be possible to prove that the prices of the selected agricultural commodities are affected by seasonality, and it will be provable that unpredictable events such as the COVID-19 pandemic have affected the prices of wheat and rapeseed.

4 Results

Graph 1 – Average monthly wheat prices in 2017-2022



Source: Authors.

The average price of wheat in the period from 2017 to 2022 is CZK 4,997 per tonne. In May 2022, the price of wheat reached its maximum (CZK 9,847 per tonne), whereas the minimum price was CZK 3,307 per tonne in January 2018. According to the graph, the biggest price fluctuation was in 2022. It was caused by the Russia-Ukraine war that started in February 2022 when wheat prices doubled.

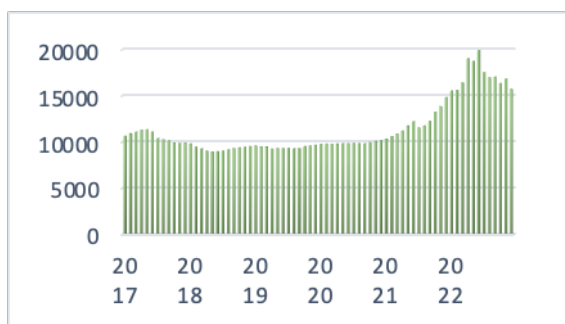
Table 1 – Wheat price statistics in 2017-2022

	2017	2018	2019	2020	2021	2022
mean	3,788	3,996	4,173	4,682	5,603	7,741
minimum	3,380	3,307	3,821	4,189	5,144	6,136
maximum	4,262	4,556	4,556	5,144	6,614	9,847
median	3,822	4,115	4,207	4,703	5,365	7,533

Source: Author

The statistical indicators of wheat prices in the above table, i.e. the mean, minimum, maximum and median, clearly show the prices, also indicating an extreme increase in 2022. From 2017 to 2021, the price trend was slightly upward and gradual.

Graph 2 - Average monthly rapeseed prices in 2017-2022



Source: Authors.

The average price of rapeseed between 2017 and 2022 is CZK 11,389 per tonne. In June 2022, the price of rapeseed amounted to its maximum (CZK 19,887 per tonne), whilst the minimum price was CZK 8,927 per tonne in May 2018. It can be seen from

the above graph that the biggest price fluctuation was in 2022, which was caused by the Russia-Ukraine war.

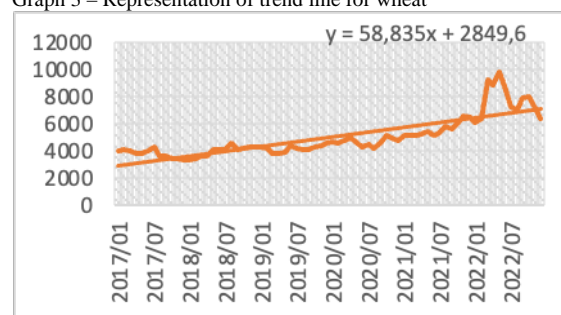
Table 2 - Statistical indicators of rapeseed prices in 2017-2022

	2017	2018	2019	2020	2021	2022
mean	10,573	9,284	9,431	9,884	12,031	17,132
minimum	9,885	8,927	9,265	9,767	10,342	15,534
maximum	11,348	9,799	9,651	10,162	14,811	19,887
median	10,519	9,300	9,411	9,841	11,741	16,897

Source: Author

The statistical indicators of rapeseed prices in the above table, i.e. the mean, minimum, maximum and median, clearly show the prices. In 2018, a noticeable price decrease can be observed. From 2018 to 2020, the price of rapeseed was stable and had a slight upward trend. In 2021, the price increased noticeably and the extreme increase came again in 2022.

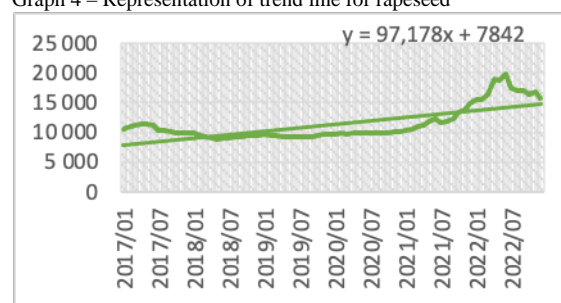
Graph 3 – Representation of trend line for wheat



Source: Authors.

A considerable rise in the wheat price from 2017 to 2022 can be seen on the linear trend line. The equation is expressed using the following formula: $y = 58.835x + 2849.6$. Given the irregular development of wheat prices and the variance compared to the straight line, trend or seasonality cannot be considered a statistically significant indicator to confirm this fact.

Graph 4 – Representation of trend line for rapeseed

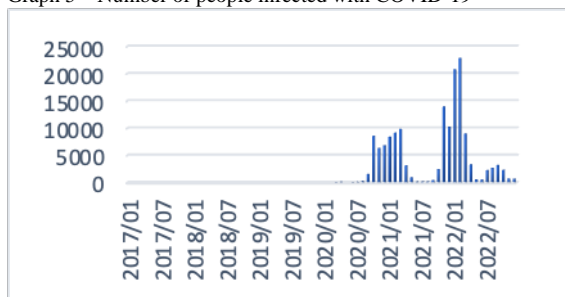


Source: Authors.

There is a noticeable rise in the price of rapeseed on the linear trend line between 2017 and 2022. The equation is expressed using the following formula: $y = 97.178x + 7842$.

Again, given the irregular development of rapeseed prices and the variance compared to the straight line, trend or seasonality cannot be considered a statistically significant indicator to confirm this fact.

Graph 5 – Number of people infected with COVID-19



Source: Authors.

In 2020, the global pandemic COVID-19 broke out. In order to determine whether there is a statistical relationship between the prices of agricultural commodities (wheat and rapeseed) and the numbers of people infected with COVID-19, the following will be applied: correlation coefficient, test statistic and critical value.

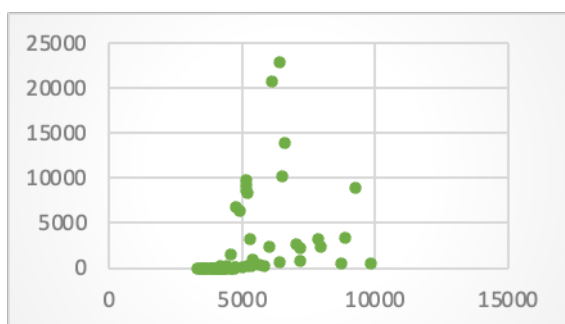
Table 3 – Correlation values of wheat and rapeseed prices with the number of COVID-19 infections

	wheat / COVID-19	rapeseed / COVID-19
correlation coefficient	0.384338	0.373491
test statistic	3.483	3.369
critical value	1.994	1.994

Source: Author

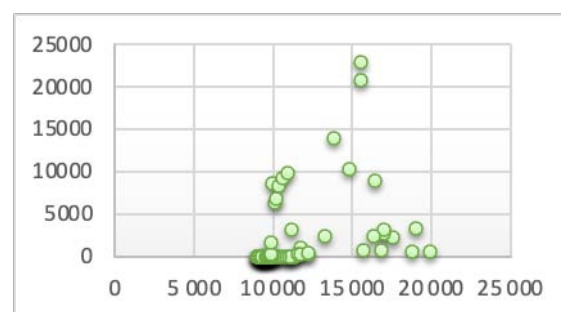
Based on the processed data, there was linear dependence between the price of agricultural commodities and the number of COVID-19 infected. There is a positive relationship between the variables, which means that when one variable increases, the other variable increases as well. However, the correlation coefficient value is quite low, hence the dependence is very weak. When comparing the absolute test statistic value and the critical value, the correlation was found to be significant. The test statistic value is greater than the calculated critical value.

Graph 6 – Correlation diagram of wheat price and number of COVID-19 infected



Source: Authors.

Graph 7 – Correlation diagram of rapeseed price and number of COVID-19 infected



Source: Authors.

With regard to the collected and processed data, the aforementioned hypothesis (H0: Extreme events affect the price of wheat and rapeseed) was confirmed. The correlation analysis showed low linear dependence between wheat and rapeseed prices and extreme events.

5 Discussion

Based on the results obtained, it is possible to answer the previously mentioned research questions:

How did the price of wheat and rapeseed develop between 2017 and 2022?

When compared to the 2015 average (=100%), the agricultural price index showed an increase of 48.1% in November 2022, while the total crop production index increased by 50.2% in comparison with the 2015 average. Regarding wheat used in the food industry, the average price in November 2022 was 7,911 CZK/t, with the price increasing by 2,306 CZK/t compared to November 2021. As for feed wheat, its price increased by 2,246 CZK/t compared to the same period last year and reached 7,470 CZK/t in November 2022 (szif.cz, 2023).

The wheat price related to the period under review (2017-2022) has an upward trend. At the beginning of 2017, the price per tonne of wheat was CZK 3,968, whereas at the end of 2022, the price amounted to CZK 6,393. The overall average price of wheat per tonne in the aforementioned period is CZK 4,997. In 2022, the price reached its maximum (CZK 9,847). In this period, the Russia-Ukraine war started, which influenced the price development. Ukraine is one of the main grain producers in Europe.

The price of rapeseed in November 2022 was CZK 16,821/t, which was an increase of CZK 2,967/t compared to the same period in 2021 (szif.cz, 2023).

Overall, rapeseed has similar price development to wheat in the 2017-2022 period. At the beginning of the period, the price was CZK 10,631, whilst at the end of 2022, it reached CZK 15,720. There is an upward trend as well. In 2022, there was an extreme price increase for wheat as well due to the Russian invasion of Ukraine, when the price climbed up to 19,887 CZK. The average price over the period under review is CZK 11,389.

How does seasonality affect the price of wheat and rapeseed?

Staugaitis and Vaznonis (2022) also present a model using season dummy variables to see if the effect of financial speculation on return volatility varies across individual seasons, as seasonality plays an important role in return dynamics regarding agriculture. They conclude that either there is no relationship between the increase in short-term speculation and agricultural commodity price volatility or the relationship is at best questionable.

Seasonality affects the price of rapeseed and wheat since these crops are seasonal and are only harvested at certain times of the year. Considering rapeseed, harvesting usually takes place

between August and October and the price usually decreases as market supply increases during and after harvest. On the other hand, if there are harvest problems, such as droughts or floods, the price of rapeseed may increase due to reduced supply. As for wheat, harvesting usually takes place between May and August. Prices usually fall with the increasing amount of harvested wheat on the market and afterwards as well. However, if there are harvest problems such as drought or diseases, the price of wheat may increase due to reduced supply. Overall, the seasonality of rapeseed and wheat prices is therefore mainly driven by market supply. Higher supply usually leads to lower prices, whereas lower supply leads to higher prices. However, the seasonality of wheat and rapeseed prices was not statistically demonstrated in the period under review. This may indicate that these commodities are produced in abundance, both from own and imported sources.

How have the events of Covid-19 and the Russia-Ukraine war affected the price of wheat and rapeseed?

Ayyildiz (2022) examined how concerns about the COVID-19 pandemic have affected grain prices globally. The global fear index (GFI) and sub-price indices were used to determine the impact of COVID-19 induced fear on grain prices. Assuming an asymmetric relationship between the variables, a non-linear model with a distributed autoregressive lag was used to determine this relationship. Based on the model results, it was found that in the long run, agricultural commodity prices responded by increasing (decreasing) to positive (negative) influences in the GFI, and that the effect of an increase in the GFI on agricultural commodity prices was greater than the effect of a decrease. Correlation analysis showed low linear dependence between wheat price, rapeseed price and extreme events in the period between 2017 and 2022. The analysis showed that COVID-19 had an impact on the price of wheat and rapeseed.

6 Conclusion

The aim of this paper was to find out price development of agricultural commodities (wheat, rapeseed) over the 2017-2022 period, trace the development, fluctuations and possible trends or seasonality with the use of descriptive analysis, and by applying correlation analysis, to determine whether the COVID-19 pandemic has affected prices of the selected commodities. It was found that the prices of both agricultural commodities were on an upward trend. The largest price fluctuation was due to the Russian invasion of Ukraine in 2022. It was illustrated on the above linear trend line that there is no statistically significant indicator that would show a trend or seasonality in relation to the price development of agricultural commodities over the period under review. Low correlation dependence of commodity price development on the COVID-19 pandemic was demonstrated.

In recent years, the development of wheat and rapeseed prices has been influenced by a number of factors such as changes in market supply and demand, the impact of weather on harvests, the development of oil and other commodity prices, political and economic factors and many others. As regards the period between 2017 and 2022, grain prices fluctuated depending on these factors, but remained relatively stable on average. Overall, it can be stated that the development of wheat and rapeseed prices in recent years has shown that the grain market is highly influenced by various factors, but has nevertheless remained at a relatively stable level. It should be noted that grain prices are very important not only for farmers but also for the overall economy as they have an impact on food prices as well as prices of other commodities.

The objective of the paper was met and all previously formulated research questions were answered using the related scientific methods employed. The research was limited to the time span of 2017-2022, examining only wheat and rapeseed as the selected agricultural commodities. If other criteria were selected, the findings could have been different. Possible future research based on the research conducted could be to compare the results already obtained with results from a larger time span, perhaps

the period after the end of the Russia-Ukraine war and COVID-19.

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Primary Paper Section: A

Secondary Paper Section: AG

SENSORY DEVELOPMENT OF SENIOR PRE-SCHOOLERS WITH DEVELOPMENTAL DELAY BY MEANS OF MONTESSORI MATERIALS

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Abstract: The results of the research of etalon images formation in pre-school children with developmental delay are analyzed. The authors focus on sensory models development in children with mental development delay (MDD), also define the main directions of sensory models development in senior pre-school age children with MDD by means of Montessori materials. Classes are conducted in specially prepared environment. As Montessori approach requires the division of the activity room into several zones, standard ones are considered to be: natural zone, practical life zone, sensory zone, language zone, and mathematical zone. The task of a teacher is to adjust to the kid's interests. It is important to create the environment for realization of his or her ideas and actions.

Keywords: mental development delay, sensory education, Montessori materials activity.

1 Introduction

Mental delay involves the entire mental sphere of the child, and is essentially a systemic defect, so the process of learning and education must be built from the standpoint of a systemic approach. The meaning of this paper is to outline a full-fledged basis for the formation of higher mental functions and provide special psychological and pedagogical conditions necessary for their formation. Purpose of the paper is to find out - ways of adaptation of children with developmental delay to the regular educational regime, as well as - methods of organization and planning educational activities, taking into account the needs of studied group of children. The main method used in our research is the method of cooperation based on the use of games, joint projects, experiments, and group tasks.

As S. Agostine et al. (2022) claims participatory sense making is one means of supporting purposeful sensory experience and patterns of sensory processing, which is vital to support children with severe disabilities in independent play and sense making. Interacting with toys in any way they independently can explore their environment by touch, sound, mouth, or vision; it should be combined with learning through the process of engaging with others to support their efforts to pursue desired outcomes or complete tasks. These are just as important and meaningful for children with severe disabilities as they are for any child.

Sensory disorders can cause poor balance, dislike of touch, dyslexia, poor expression, and inattention, and are mainly classified as tactile disorders, proprioceptive disorders, vestibular balance disorders, language disorders, and spatial and auditory disorders. These disorders are very detrimental to the healthy development of the individual child and are prone to lasting and widespread adverse effects (Jinting et al., 2023). /.../ given their emphasis on individualized instruction, child-directed learning with self-corrective materials, and teachers acting as motivators and facilitators of learning rather than didactic instructors of specific skills, Montessori classrooms may provide the ideal environment in which to implement inclusion (Long & Ferranti, 2022, p. 20). Being a follower of classical humanism, Montessori managed to formulate the concept oriented to the personality of a child in its center, to the assurance of a child's capabilities to achieve success. And even more: the system allows a child to develop thanks to independent activity.

The central idea of Montessori's teaching is based on the need for the pedagogue to create a subject-spatial environment in which the child could fully reveal his inner potential in the process of free independent activity. This environment should allow each child to develop at his or her own pace. The task of the educator is primarily to provide the child with the means for self-development and to reveal the rules for their use. Such tools are the autodidactic (self-learning) Montessori materials with which the child works, first acting according to the pattern, and then - performing the exercises independently (Dudnyk, 2017).

Maria Montessori is an Italian doctor and pedagogue who dedicated all her life to children. Working with disabled children she managed to build up a system which allows to improve motor and sensory skills of a child. In the process of studying the teacher appears to be an assistant, and a mentor for children. Montessori's method is recognized as the most requested one in modern pedagogy, the fact being confirmed by the number of educational establishments which follow it. The main principles of this approach are maximum of wish, and minimum interference into the process of natural development of a child. Every year, schools and nurseries which work with Montessori's system, are gaining popularity, as many parents dream for their children to be educated in the environment which promotes dynamic development of every kid. The first elaborations by M. Montessori were oriented to the development of sensory perception and motor skills of a child.

Modern Ukrainian educational community faces the choice of psychological teaching techniques which are personally-oriented, and which can satisfy all state demands connected with pre-school child development. This demand is reflected in the theory of free education which appeals for emotional well-being maintenance through personal-oriented approach to every child, namely, respectful attitude to his or her feelings and needs.

The program "Montessori nursery school" includes the following thesis (Montessori, 1912): – personal-oriented educational model: Montessori-pedagogue follows the mental and physical health of every nursing; – education of an all-rounded personality: in a Montessori nursery school a child becomes acquainted with the world on all its manifestations; – inheritance of goal marks: development of self-dependence and self-initiative in various activities, development of imaginative thinking; – arranging of developmental objective-spatial environment: corresponding Montessori-materials are selected according to each content-related educational area. Implementation of the program in pre-school organizations, as well as systems of work, and Montessori-materials will provide proper and all-round education. /.../ without constant development of sensors, it is impossible to get to know the peculiarities of the natural and social environment and their sensory characteristics. Sensory education is closely related to the mental development and upbringing of adolescents. It appears as its basis, since sensory education takes place in the process of various types of children's developmental activities: work in nature, construction, drawing, application, etc. which require the active participation of both sensory and mental processes. Sensory education is of utmost importance for the proper functioning of thought processes (Doncheva et al., 2022, p. 36).

2 Literature Review

In modern literature the issues concerning sensory education of pre-school children with developmental delay, and the influence of Montessori-materials on sensory models development, within the framework of developmental correctional work of pre-school children with MDD, are acquiring *special topicality*. Sensual experience is the first step in perception of surrounding world. It is sensory education which is directed to the development of overall child's perception of the space around him/her.

Successfulness of cognitive, physical, and aesthetic education is dependent on the level of children's sensory development the latter playing a great role in psychological, and social formation of a personality. Sensory development of a child is the development of perceptions about environment objects features: their form, colour, location in space, sounding, and even taste. Pre-school age is considered to be the most intensive period of sensory development as it is the period of improvement of orienting-spatial perceptions.

Peculiarities of sensory development of pre-school children with delay has been studied by V.V. Zasenkov et al. (2008), A.A. Katayeva et al. (2021), A.A. Kolupayeva (2010), I.I. Mamaichuk (2006), K. Panasenkov et al. (2023), Yu. Ribtsun (2015), Jenna N.Adams et al. (2015), B. L Baker et al. (2003), A. Juodraštis et al. (2008), Aznita Iryany Mohd Noor et al. (2022) etc. These authors explored that such children find orientational-scientific activity, which is pointed at the research of qualities and specifications of objects, difficult. Also, these children haven't yet formed the notions of the form, colour, and size. They don't differentiate between a ball and an air balloon, between similar in color objects, they are not able to arrange the objects in order of size. The main problem appears to be in the fact that their sensory experience is generalized more slowly, and is not fixed in a word; there are mistakes in naming color, form, and size peculiarities, all these marking non-formation of model imagination in these children.

Senior pre-school age children are slow to learn and understand new, unknown material. In order for them to learn how to become inquiry, attentive and active, to be able to acquire new material some playing methods, e.g. travel-game, may be used. The content of such games may be filled with different sensory exercises thanks to which the tasks of topical advanced systematic developmental correctional work in sensory development of children with MDD are solved. Sensory development of a child with MDD on the whole gets behind the deadline, that is why the formation takes place unevenly (Mamaichuk, 2008).

The criteria which influence sensory development of children badly are the following: – delay of movement functions which becomes vivid in slow decay of some unconditional reflexes; – slowed, and often inconsistent formation of locomotory functions such as holding the head, body overturn, sitting, uprising, crawling, treading, etc. – belated development of sight fixation which is manifested in difficulties while watching the objects; – underdevelopment of visual-motor coordination, that is belated development of sensorimotor functions; – decrease of cognitive activity; – immaturity of emotional-volitional sphere which is expressed in late appearance of a smile and the whole complex of liveliness, and in belated differentiation of emotional reactions to the environment; – delay in the development of a mentally active child (ibid.).

The problem of sensory development of a child with MDD is *topical*, thus requiring *further research*, as without modern special resource influence etalon perceptions in children with MDD will not be formed, even till the end of pre-school period, attesting ill-preparedness of children to school. The research of the problem of pre-school age children development has its tradition. The most significant investigations in this field were conducted by modern researchers V. M. Koshelev (2019), T. Krasova et al. (2021), K. Lutsko & O. Kryhlyuk (2021), V. Ya. Pupyshcheva (2015), Ye. G. Sarapulova (2015), V. Romenkova (2023), Aniyah Manja Syazwani et al. (2022), J. Paynter et al. (2023), Zavitrenko D. et al. (2022).

Instructional Montessori-materials is the phenomenon whose boundary is between workbooks, educational toys, and things of everyday routine. Anything may be used as the object of the game, specifically a chair, a plate, a spoon, a sponge, cereal, water, etc. These may be usual clothes pins, paper colourful fasteners, chestnuts used in didactic games for children which help to develop tactile sensibility, thinking, fine motor skills of hands, colour perception, memorizing of geometric objects;

these also may be different geometrical objects (bricks, cylinders, etc.), plates, tablets, frames with different colours and patterns; things with the elements of fasteners, ropes (for fine motor skills development and household habits). For three-year-old kids who sometimes can define neither colour, nor the object itself, it is better to use floppy objects with the help of which such games as "Plant the bed", "Pick the fruits" may be conducted. The task to tack a yellow flower on a yellow button, a blue flower on a blue button may be set to children. So, firstly, the notion "the same" is formed and then the flowers, and their names are memorized.

3 Materials and methods

In the process of working with children with developmental delay, we found out that they have a peculiar cognitive activity.

- In particular, all children with developmental delays have reduced attention. We found out the different nature of the decrease in the stability of attention: maximum concentration of attention at the beginning of the task and its subsequent decrease; periodic changes in the intensity of attention and its decline during the entire working time.
- Inferiority of visual and auditory perception is observed, as well as spatial and temporal disorders, lack of planning and failure to perform complex tasks. Such children need more time to absorb and process visual, auditory, and other impressions. Similar qualities of objects are perceived by them as the same (an oval, for example, is perceived as a circle).
- Also, our observation revealed that those types of memory that require frequent mental processes are particularly affected. In particular, mechanical memory is characterized by reduced productivity of the first memorization attempts, although the time required for complete memorization is close to the norm.
- With regard to thinking, quite high indicators are observed when performing tasks according to a visual sample, however, some difficulties are caused by those tasks in which there is no visual sample.
- We also found some peculiarities in the speech activity of the observed group of pupils. In particular, the vocabulary is insufficient, even poor (especially active); there are difficulties in mastering the grammatical structures, and violations in the formation of monologue speech. Such children made mistakes in distinguishing sounds, they couldn't extract sentences from the text. These features of speech activity created considerable difficulties in teaching them to read and write.

The productive time for such children appeared very short (15-20 minutes), after which fatigue occurs. Such children become distracted, not knowing where to start, asking the teacher repeatedly; going from one activity to another without finishing any of the work they have begun. So, the use of materials from the Montessori program became expedient in our study.

The program by M. Montessori accounts for a child's acquisition of form, colour, size of objects, as well as his or her development of acoustic, kinesthetic, and other sensory receptors, with the help of using different didactic games. It may be said that sensory perception is the background of harmonious development of children. Montessori-materials serve as the most important means of sensory perception of children which represent the core of studying process in pre-school and junior-school age. These materials are composed in such a way a child could update his or her practical skills and sensory capabilities.

3.1 Participants

Sensory development of children with MDD has its peculiarities which is manifested in imperfect formedness of sensory samples. In order to be certain in validation of such a conclusion we conducted a *summative assessment*. The research was conducted in Public municipal school "Residential educational establishment "Special comprehensive school of I-II grades № 1

– preschool educational establishment of Kropyvnytsky City Council of Kirovograd region”, Ukraine. 20 children participated in the experiment: 10 of them have sound mental health, 10 children have mental development delay.

For diagnostic assessment such methods as “Colours” technique, “Forms” technique, “Size” technique (Chebotariova et al., 2020, p. 55-57) were used. In accord with the results of this diagnostic assessment the conclusion may be made that the majority of children with MDD *do not know* sensory models, as well as the words of expression them. These children *do not use* such words either in active or passive vocabulary, their motor skills, namely hands movements, are imperfectly formed. All these confirm *the necessity of a special intervention program implementation aiming at etalon images development* in senior pre-school age children with MDD.

3.2 Procedure

Within the scope of received results we *worked out* the schedule of corrective actions directed at the development of sensory samples of children with MDD with the help of Montessori-materials. The *purpose* of suggested corrective actions is the development of sensory samples in senior pre-school age children with MDD. The main *tasks* of corrective actions concerning the development of sensory samples in senior pre-school age children with MDD are as follows:

- correction of sensory processes and coordination;
- correction of cognitive activity;
- development of motor skills;
- development of interest, and enforcement to actions;
- formation of skills to interact with subjects;
- formation of motivation to studying.

Classes with children aged from 4 to 7 were conducted twice a week. Duration – 20-25 minutes. The Program realization stages were the following: 1) March, 2023 – investigation problem diagnostics; 2) April, 2023 – elaboration of the program; 3) May, 2023 – implementation of the program in “Residential educational establishment “Special comprehensive school of I-II grades № 1 – preschool educational establishment of Kropyvnytsky City Council of Kirovograd region”, Ukraine; 4) June, 2023 – formulation of results.

The Program was divided into modules each being responsible for the development of certain sensory samples:

1. Introduction.
2. Formation of sensory samples diagnostics (Unit 1 contains 4 classes for learning basic colours; Unit 2 includes 4 classes for learning geometric figures; Unit 3 embraces 4 classes for learning size).

Observations were supplemented with work samples, instructional materials, and photographs of the classrooms. Documents such as pupil’s Individual Education Programs and curriculum requirements also contributed to the data of this study.

3.3 Ethical Criteria

The design of the research is based on the principles of respect for the individual, anti-discrimination, gender equality, validity, professionalism, and consistency of conclusions. All stages of the pedagogical experiment correspond to the generally accepted academic ethical principles of research work.

4 Results and Discussion

In order to purposefully train and correct the mental development of a child, it is necessary to know the shortcomings of the development of his/her individual mental functions, to be aware of the interconnection and interdependence between them. It is practically impossible to separate the development of

perception, thinking, memory and other functions by first forming one and then the other.

Pupils with mild intellectual disabilities have been found to have lack of formation of speech operations. Communication in their native language is only developed at a sufficient level in everyday situations. Schoolchildren construct sentences grammatically correctly, pronounce words, master reading and writing, but have difficulty perceiving speech, which consists of complex logical-grammatical constructions. In the semantic dimension, the vocabulary is rather poor, the acquisition of the meanings of words causes difficulties. /.../ there may also be a situation where speech is not formed for many years (Truhan, 2022, p. 177-178).

From *our experience* of working with these children, we have considered the following features:

- since the main characteristic of children with special educational needs is a lack of knowledge about the world around them, we focus on developing their observation skills, practical experience, and the ability to independently acquire and use knowledge;
- the most typical gaps in knowledge were identified in order to gradually prevent these children from falling behind their peers;
- knowing the lack of activity and the reluctance of children with developmental delay to operate even with the knowledge they already had, we encouraged them to be as active as possible in the classroom, encouraged even minor achievements in order to create the atmosphere of positive attitude and constant support;
- especially at the first stages of training, we used visual aids and explained even not quite complex notions in detail;
- taking into account the difficulties of memorization and impairment of working capacity in the process of performing practical tasks, the teacher additionally explains the educational material, gives the opportunity to perform the tasks at a slower pace, allows to ask additional questions for the purpose of deeper disclosure of the content of the task;
- tasks are divided into components to form the ability to plan activities and verbally report on their performance;
- the pace of work and working capacity of the child gradually increased;
- taking into account the emotional age lag of the studied group of schoolchildren, the number of game techniques in the learning process decreased gradually, without the use of sharp prohibitions;
- if necessary, the number of tasks given for independent processing was reduced.

We consider the usage of Montessori-materials at the lessons *effective as they allowed* to form such skills in children:

- 1) skills of different movements by fingers and hands while exploring things;
- 2) skills of recognizing, and naming sensory samples;
- 3) ability to be aware of space;
- 4) skills of social, and emotional response;
- 5) aptitude for sensible actions with objects.

The *results* of deadline assessment disclosed the effectiveness of corrective actions aimed at the development of sensory perceptions of colour, as far as the majority of children could not only point to, but also name both basic, and additional colours. Difficulties connected with naming geometrical objects were diagnosed in children with mental development delay, so, based on the results of the test experiment it became possible to indicate positive dynamics in the development of the idea of geometrical figures, and extension of vocabulary in pre-schoolers. On completing developmental-correctional classes the number of children with MDD, who coped with the tasks *increased*, which mark the growth of imagination of size in senior pre-school age children with MDD.

In order to increase the motivation of learning and cognitive activity in students with MDD, we *propose* to introduce a *system of exercises* into the learning process, in parallel with the use of Montessori materials that can be performed both in the classroom under the supervision of the teacher and at home under the supervision of the parents.

The first group of exercises is focused on developing attention, because children with MDD especially suffer from lack of voluntary attention when purposeful activity is required. They are called 'name the number', 'find the mistake', 'make a pattern out of sticks'.

The second group includes exercises to improve spatial perception. These include the exercises 'what objects is it made of?', 'what is where?', 'labyrinth: help find the way', 'guess what is depicted'.

The third group includes games and exercises for improving time perception: 'tell the time', 'determine the season by objects'. As we found out, the perception of time is especially difficult for children with MDD as duration, speed, and sequence of events are perceived by them with considerable effort. In games and exercises, it is more effectively to consolidate ideas about parts of the day (morning, afternoon, evening, night), days of the week, months, time-markers: before, later, first, then, before.

The fourth, the most important, group of exercises are games and exercises for the development of thinking and speech. These are the exercises 'guess the riddle', 'name the word that begins with the last letter', 'name words with opposite meanings', 'compose a short story based on pictures'. As it turned out, the use of such exercises in lessons contributed not only to the activation of mental and linguistic activity, but also to development of such mental processes as thinking, memorization, imagination.

Modern educational portals offer a variety of interactive types of work (Edx. education, 2021), which give pupils with special educational needs the opportunity to transfer previously acquired knowledge, skills and abilities to new activities and situations of speech interaction. While using of various forms of interactive activities, pupils with special needs work in a group of peers, where they can freely express their opinions, mobilize knowledge, and demonstrate creative, organizational, and leadership potential (Kazachiner, 2019, p.165). When organizing the education of children with disabilities, it is necessary to take into account the low work capacity and the peculiarities of their cognitive activity. Only if the child's psychophysiological capabilities and the difficulties he/she may face in the learning process are clearly defined, effective pedagogical conditions for child's full development can be created (Shapochka, 2007, p.135).

5 Conclusion

The results of our observation showed that the path of adaptation of children with developmental delay to the regular educational regime is long and painstaking, so it must be clearly planned and organized. The main condition here is to avoid coercion which has no positive outcome, can distract the child from learning, and provoke aggressive behavior. It is not appropriate to assign difficult speaking roles in dialogic speech, as heavy texts may be overwhelming for a child with MDD, especially when it comes to improvisation. Only later, when other children have worked through the speech material of the game, an attempt may be given to a child with MDD.

We also believe that children with intellectual disabilities, like other children with special educational needs, have the opportunity to master other knowledge, a foreign language, in particular, at least at an elementary level (greetings / farewells, naming family members, colors of objects, interior of an apartment, the simplest actions, etc., construction of simple sentences, questions, etc). Therefore, the development of ways and methods of teaching a foreign language the researched group

of pupils, as well as systems of exercises for them, we consider a promising area of work with children with special educational needs.

We find it reasonable to continue researching in the described above direction in order to prove the effectiveness of our research ways, with its further implementation into the educational process of children with MDD, as well as to implement this method for other categories of children.

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Primary Paper Section: A**Secondary Paper Section: AM**

ENHANCING PUBLIC TRANSPORTATION SUSTAINABILITY: AN ECONOMIC FEASIBILITY FRAMEWORK FOR EFFECTIVE REGIONAL GOVERNANCE

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Abstract: This study seeks to address rural transportation sustainability by exploring the inclusion of demand-responsive transport (DRT) into the public transport system. To assess the feasibility of this approach, an agent-based model has been developed to calculate the costs and revenues and applied in case study of rural region of eastern Slovakia. While the DRT operations are generally unprofitable, under specific conditions, 31% of routes serviced by DRT recorded lower losses than bus transport, particularly in areas with low demand and during off-peak hours. These findings imply that DRT could serve as a viable option in enhancing rural transport accessibility and bolstering the cost-effectiveness of public transportation, however, it cannot entirely replace conventional bus transport.

Keywords: DRT, fixed-route transport, effectiveness, framework

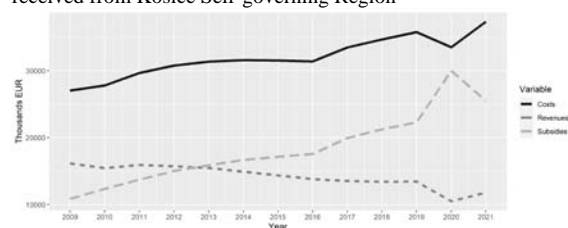
1 Introduction

Current society is marked by rapid urbanization, increasing environmental concerns, and growing demands for accessible transportation networks. The sustainability of public transit systems has emerged as a critical issue, especially questionable is the sustainability in rural areas. Among the currently available various modes of public transportation, bus transport has long been a cornerstone of rural mobility, providing essential connectivity for regions worldwide. However, as cities grow, the accessibility of rural regions while managing limited resources is coming under scrutiny. This paper delves into the challenges facing rural bus transport, with a particular focus on the economic aspects that make it a daunting proposition for regions seeking to sustain accessibility in their less densely populated areas.

In this context, it is essential to explore the challenges and opportunities posed by bus transport sustainability. This paper scrutinizes the economic implications of bus transportation, shedding light on the true cost of maintaining these systems and examining their impact on regional budgets. Moreover, it introduces alternative transportation solution and innovation that may provide more sustainable and cost-effective alternatives, ultimately aiming to contribute to the discourse on the future of urban mobility.

Similar challenges can be observed in Slovakia on the regional level. The Košice Self-Governing Region as the research area grapples with the pressing issues of increasing costs and diminishing transport demand, making the bus transport unsustainable for the future. During the lockdowns due to COVID-19 pandemic, the subsidies for bus carriers rose by a considerable margin due to the reduction in passenger traffic, as illustrated in Figure 1.

Figure 1 Costs, revenues of bus operators with subsidies received from Košice Self-governing Region



Source: Author's contribution based on KSK (2021)

As highlighted by Štofa et al. (2023), the decline in passenger traffic resulted in lower revenues for bus carriers, making it increasingly difficult to sustain their operations. At the same time, the carrier costs have remained high, and so they needed additional support from municipalities. Altogether, rising costs, decreasing number of passenger and the ecological impact are rendering this system of transport unsustainable.

This paper seeks to undertake an in-depth economic feasibility analysis of bus lines and aims to formulate a holistic approach for regions to proactively tackle the sustainability challenges of public transportation. The primary objective is to not only improve regional accessibility but also to concurrently mitigate the financial burdens associated with public transportation. While this approach is demonstrated using a specific region in Slovakia as a case study, its applicability and relevance extend beyond geographical boundaries, making it adaptable and transferable to various regions worldwide.

2 Literature review

The challenges inherent in sustaining accessible transportation networks in rural and remote regions represent one of the main issues of transportation. As the costs and logistical complexities of maintaining traditional bus transport systems in these areas continue to mount, alternative solutions have gained traction as potential remedies. This literature review seeks to explore the applicability of Demand-Responsive Transportation (DRT) as a solution to the pressing problems of accessibility and sustainability in rural and remote areas, as suggested by Liu & Ouyang (2021), Mortazavi et al. (2023) and Zhu et al. (2020). DRT is defined as a transportation system that adjusts to the current demand by either adapting the routes or schedules of the vehicles or by allowing passengers to pool their rides (Coutinho et al., 2020). Implementing DRT into public transport to combine multiple modes or to supplement public transport by using DRT as feeder service could increase the sustainability of public transport. However, as Gomes et al. (2015) suggest, the success of DRT projects is not always guaranteed. The previous projects implementing DRT systems have faced challenges, including high operating costs, as highlighted by Currie and Fournier (2020) and Enoch et al. (2006). Košice Self-governing Region meets several preconditions for successful DRT survival as lower employment density, less densely populated region, poor connectivity to road networks and increasing problems with parking mentioned by Wang et al. (2023) and Wang et al. (2015).

Despite the aforementioned challenges, DRT offers a more flexible transport option than traditional fixed-route bus transportation. In particular, DRT can be implemented as a door-to-door service, which provides passengers with greater convenience and reduces the need for additional transfers. In addition to reducing costs, implementing DRT can result in several secondary benefits, such as lower travel times (Caulfield, 2009), lower greenhouse gas emissions (Caulfield, 2009; Jacobson & King, 2009; Yu et al., 2017), and increased accessibility for individuals with reduced mobility. These benefits are supported by Coutinho et al. (2020) and Wong et al. (2020).

In some studies the DRT has been considered as a direct competition to public transit service (Sadowsky & Nelson, 2017; Zhu et al., 2020). Studies usually use a grid structure as network topology or a hub structure (Newell, 1979) or a hybrid topology as used in Daganzo (2010). In this paper, the primary intention was to replace inefficient bus routes rather than create an entirely new DRT network. To achieve this, we have modified the existing network of fixed bus service providers in the region by including DRT in specific cases. The proposed framework also takes a different approach by analyzing each bus route separately, as suggested by Ryley et al. (2014). While DRT

services are rarely financially viable, the main objective of this paper is to reduce regional subsidies for transportation companies. Thus, while financial viability is a desirable outcome, it is not the primary goal. The proposed implementation of DRT system into bus transport system must create lower losses than the current mode to be considered a viable alternative. In low population density areas with low occupancy rates, a lower DRT service standard than in urban areas may be necessary. Viergutz and Schmidt (2019) suggest that a less flexible DRT service, characterized by fixed schedules, fixed routes, and the necessity of pooling, may be appropriate in such cases. Additionally, passengers may need to order tickets at least a few hours in advance to enable adequate trip planning.

One of the commonly applied methodologies to evaluate feasibility of implementing DRT is by utilizing agent-based simulation as stated by Ronald, Thompson, and Winter (2015) or Fagnant and Kockelman (2018). Agent-based models simulate demand and supply behavior. While this study expects the demand will be similar to that of fixed bus with fluctuations throughout the day in accordance with the actual occupancy of fixed transport. Additionally, the supply aspect of DRT can accommodate demand by dispatching more vehicles, with each DRT vehicle ready in accordance with the bus schedule and serving specific bus stops. The DRT route can be dynamically altered based on demand, allowing for efficient navigation by avoiding empty stops and selecting the quickest path. This paper adopts simple agent-based model to simulate the movement of passengers based on the real-world data from bus transport.

The aim of this paper is to introduce a framework for the integration of DRT into fixed-bus transportation and subsequently applying it in a case study within the rural areas of the Košice Self-governing Region in Slovakia. Considering previously mentioned challenges associated with DRT, this paper endeavors to identify the most feasible integration of DRT within the existing bus transport system, while the profitability has been employed as a main metric to quantify the suitability and extent of such an integration.

3 Research Methodology

In this study, the primary source of information used to model the demand for transportation within the Košice self-governing region was the data from the purchase of standard day travel tickets. This dataset provided crucial information, including the number of passengers traveling on specific bus routes, the origin and destination of each passenger, fares, and the route itself. It is important to note that the dataset used for this analysis represents only one day of travel. While this dataset may offer valuable insights into travel patterns on that particular day, it may not accurately represent travel patterns on other days or over a longer duration.

As a secondary source of information, a list of bus routes operated by bus transport companies in the region for the year 2018 was obtained. This data was utilized to gain insight into the existing fixed-route bus transport system in the area, facilitating a comparison of its performance with that of Demand-Responsive Transit (DRT). In total, 3,643 bus routes were analyzed, serving more than 600 towns, with each bus route being served multiple times throughout the year. Descriptive statistics for these bus routes, covering the entire year, are presented in the following table. These bus lines can be served by multiple buses a year, and all the essential descriptive statistics as distance traveled in km and passenger-kilometers (PKM), occupancy of buses, costs and revenues are presented in Table 1.

Table 1 Descriptive statistics of bus routes for the year 2018

variable	mean	sd	median	min	max
Bus lines per year	240.85	44.70	249	80	365
Distance traveled	5438.74	4614.89	4312.7	94.50	35955.60
Max bus capacity	50.62	13.51	49.82	3.94	104.55
Occupancy	20.30	16.22	16.81	0.01	101.2
PKM	68018.79	89808.01	36574	0	874086

Route revenues	3080.11	3539.12	1926.67	0	31893.20
Route costs	7032.56	5952.35	5510.40	115.07	48363.88
Route subsidies	3952.45	3733.22	3149.76	-5546.26	30021.82

Source: Author's contribution

Due to the significant decline in mobility caused by the COVID-19 pandemic, pre-pandemic occupancy levels and other relevant data have been used. This approach is supported by the study conducted by Campisi et al. (2021) which highlighted the need to consider the pre-pandemic levels of transportation demand when analyzing the performance of public transport systems.

The proposed DRT system has a fixed schedule but partially adaptive routes, based on pooling a few hours earlier. The demand for DRT was modelled by analyzing the occupancy rates of real buses in the Košice Self-governing Region. While König and Gripenkoven (2020) suggest DRT services are often underutilized, the proposed DRT system will replace the non-viable bus routes and therefore we assume the same level of demand for DRT and buses. On the other side, the supply is made of network of private carriers, operating private fleet, and organized by one joint system. Considering that buses offer higher passenger capacity than DRT vehicles, this paper tries to analyze the distance travelled by one or multiple DRT vehicles, to ensure all passengers reach their destination. Therefore, it is expected, that economically viable routes served by DRT will be those in only low-demand areas during off-peak hours.

To overcome the challenges associated with identifying and locating all bus stops, the simplification of bus stops has been introduced where the bus stops have been replaced by individual towns along the bus route. While this approach helps to simplify the computation process, it also brings with it potential inaccuracies in estimating the route lengths between towns, especially in cases where the bus serves only crossroads before villages.

Given the challenges associated with accurately estimating the costs of implementing a DRT system, the market research was conducted to understand the current costs of private transport. It is expected that private carriers set prices that cover all costs associated with providing the service, while also generating a reasonable profit margin. Therefore, we assume that all costs associated with operating a DRT system can be part of these prices.

Additionally, due to low demand for transportation on some bus lines and the need to provide service to all passengers, we have selected minibuses as the primary vehicle type for DRT implementation. These vehicles have a maximum capacity of 8 passengers and are more suitable for low-demand areas where larger buses would be uneconomical.

According to the source data for costs and distance travelled, the standardized operating costs per km for buses have been identified and denoted by c^{buskm} , which is subsequently used to evaluate the costs of bus route for one day. Utilizing the information regarding ticket sales, it is possible to analyze the revenue generated by a particular bus route. Consequently, the costs of operating the buses, c_i^{bus} , the revenues generated by the buses r_i^{bus} and bus route profitability π_i^{bus} have been calculated as follows:

$$c_i^{bus} = c^{buskm} * d_i^{bus} \quad (1)$$

$$r_i^{bus} = \sum_{j=1}^n p_{ij}^{bus} \quad (2)$$

$$\pi_i^{bus} = r_i^{bus} - c_i^{bus} \quad (3)$$

where

- i is i -th route
- c_i^{bus} is daily fixed-route transport costs for i -th route
- c^{buskm} is standardized costs of fixed transport per km
- d_i^{bus} is distance travelled by i -th route
- r_i^{bus} is daily fixed-route transport revenues for i -th route
- j is j -th passenger on i -th route

n is number of passengers in bus route i
 p_i^{bus} is ticket price for i -th route for j -th passenger in bus
 π_i^{bus} is profitability of i -th route

Subsequently, a distance matrix of all towns in the Košice Self-governing Region was generated for analysis. This matrix was utilized to analyze the distance that the DRT vehicles must cover in order to fulfil the estimated demand for a standard day to identify cost-effective way of meeting local transportation needs, as applied in Davison et al. (2014).

In this paper, an agent-based model has been designed to replicate the passenger transportation network, replacing buses with DRT vehicles. Each passenger is represented as an agent in the model. These agents possess attributes such as origin, destination, and departure time. On the other side, DRT vehicles are introduced as mobile agents which follow route of the buses. These vehicles have a fixed capacity of 8 passengers and are capable of dynamically editing their routes, if no demand is on the way. When a DRT vehicle reaches full capacity or if a passenger's request cannot be accommodated due to vehicle occupancy, a new DRT vehicle is dispatched to continue serving the route. The primary metric of interest is the total kilometers traveled by DRT vehicles, which is calculated as the sum of distances covered for all trips made by the vehicles.

As the initial location of DRT vehicles cannot be predetermined, this model takes into account the return journey of DRT vehicles, while allowing them to start from either the starting or ending town of the bus route. Therefore, two distances for DRT vehicles have been calculated, which represent the total mileage of DRT vehicles required to serve all passengers on i -th bus route based on the demand and distance matrix, starting from either the first or terminal bus stop of the specific bus route.

Standardized costs of DRT vehicles have been determined by market research and set on level 0.738 EUR/km. By analyzing the starting and ending locations on the tickets, an estimate of the ticket price based on the distance travelled d_{ij}^t by passengers on a specific route could be made. As the passengers are willing to pay more for better services and accessibility, we have decided to set the price per km p^{drtkm} on the level of willingness to pay 0.09 EUR/km, based on the Čopová (2022) research. This value is 34.12% higher than average fare of bus transport in Košice Self-governing Region, which also corresponds to the recommendations of Kim, Moon, and Kim (2017), who suggest an optimum price strategy for DRT that takes into account the cost of operation and the fares charged by other modes of transport, such as buses.

It is anticipated that the fares set for DRT will not be sufficient to cover all the costs associated with its operations. Therefore, the remaining costs would need to be subsidized by the government, in this case, the Košice self-governing region. However, the goal is to achieve at least the same level of accessibility of rural areas while utilizing a lower number of subsidies. Based on the previous assumptions and simplifications, the costs and profitability of DRT can be calculated as follows:

$$d_i^{drt} = \frac{d_i^{drt\ start} + d_{2i}^{drt\ end}}{2} \quad (4)$$

$$c_i^{drt} = d_i^{drt} * c^{drtkm} \quad (5)$$

$$r_i^{drt} = \sum_{j=1}^n d_{ij}^t * p^{drtkm} \quad (6)$$

$$\pi_i^{drt} = r_i^{drt} - c_i^{drt} \quad (7)$$

where

i is i -th route
 d_i^{drt} is average distance travelled by DRT on i -th route
 $d_i^{drt\ start}$ is distance travelled by DRT for i -th route starting from first route stop
 $d_i^{drt\ end}$ is distance travelled by DRT for i -th route starting from terminal route stop

c_i^{drt} is daily DRT transport costs for i -th route
 c^{drtkm} is calculated costs of DRT per km
 r_i^{drt} is daily DRT revenues for i -th route
 j is j -th passenger on i -th route
 d_{ij}^t is distance travelled by j -th passenger on i -th route in DRT transport
 p^{drtkm} is price of DRT ticket per km
 π_i^{drt} is DRT profitability of i -th route

Subsequently, the costs of DRT and buses have been compared for each bus route. Since fully occupied bus requires to be replaced by multiple DRT vehicles, the costs of DRT transport can be substantially higher than those of bus transport. However, DRT transport is expected to generate higher revenues than fixed-route bus transport, therefore the profitability of DRT vehicles has been compared for every route. Therefore, the savings for each route have been computed.

$$s_i = (\pi_i^{drt} - \pi_i^{bus}) * b_i \quad (8)$$

where

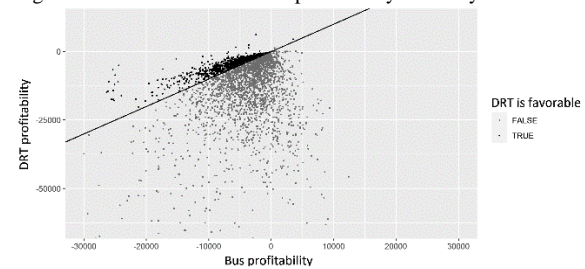
s_i represents yearly savings for i -th route
 b_i represents number of bus connections

If the profitability of the DRT transport exceeds that of the bus transport, it implies that DRT is generating higher revenues and/or incurring lower costs than buses for that particular route. As a result, the route is deemed favorable for DRT transport, as it would result in cost savings or increased profitability.

4 Results of case study

The designed framework has been subsequently applied to the data Košice Self-governing Region, encompassing 3643 bus routes with the data collected for a standard day. Notably, a majority of bus routes and nearly all DRT routes resulted in losses, which have to be subsidized from the budget of Košice self-governing region to ensure the sustainability of transport services. Out of these, 1135 bus routes served by DRT exhibited a higher profitability, respectively lower losses, than fixed-bus transport, as evidenced in Figure 2. Hence, it is more advantageous for these routes to be serviced by Demand-Responsive Transit (DRT) transport.

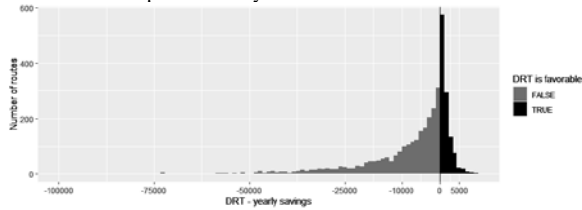
Figure 2 DRT and Buses annual profitability for every route



Source: Author's contribution

Municipalities could implement cost-saving measures on these routes in form of DRT application, and despite the fact that DRT routes will result in losses in most cases, these losses are still lower than those incurred with fixed-route bus transport, making the adoption of DRT transport a viable option. As illustrated in Figure 3, the potential annual savings can reach up to €10,000 per bus route. However, for bus routes with high passenger demand, the negative savings may be significantly higher due to the limited capacity of the minibuses utilized in this framework. Unlike buses, minibuses cannot exceed 100% occupancy as standing passengers are not permitted. Consequently, multiple minibuses must serve a single bus route, leading to substantially higher losses when employing DRT.

Figure 3 Histogram of annual savings using DRT instead of fixed-route transport for every route



Source: Author's contribution

To ensure that DRT implementation is economically viable, it is essential to consider the fluctuations in demand that can occur throughout the year, which was not part of this paper. In some cases, it may be more appropriate to use a larger vehicle, such as a minibus, that can serve the entire route in less trips in case of high demand. In the analysis of Košice Self-governing Region, we found that the median of positive savings was only 1137.11 EUR. Therefore, it is important to carefully select the most economically viable routes for DRT implementation. In general, it can be asserted that DRT has the potential to alleviate the financial burdens of municipalities, as underscored by Park & Jung (2019).

It is important to consider that demand for bus routes can fluctuate over time, and so, the savings may not be consistent throughout the year. In the following figure, we have identified all the routes with savings over 2000 EUR a year. In total 324 bus routes identified are represented with the figure below.

Figure 4 Bus routes identified for replacement by DRT with estimated savings over 2000€ a year



Source: Author's contribution

It is important to consider the potential fluctuations in demand and the need for a more detailed analysis of individual buses' economic viability. Other external factors may also impact the savings identified in this analysis, highlighting the importance of ongoing evaluation and adjustment. Therefore, in the next step, we propose conducting a Willingness to Pay and conjoint analysis. To facilitate this, we have pinpointed seven recurring settlements where the possibility of substantial savings becomes apparent when transitioning from bus to DRT.

Table 2 Selected settlements for WTP and Conjoint analysis

Settlement	Bus routes replaceable by DRT	Yearly savings (EUR)	Average occupancy in persons	Bus Fare (EUR)	Distance to district city (km)
Hažín	14	46779	7.9	1.10	11
Spišské Vlachy	46	79996	6.8	1.70	22
Jasov	23	52514	7.8	1.90	29
Mlynky	12	42413	10	2.50	42
Nížná Hutka	12	23200	11.1	1.10	13
Jablonov n. Turňou	14	36698	7.4	1.30	17
Závažka	8	46876	10.4	1.30	15

Source: Author's contribution

As evident from Table 2, the average occupancy of the identified bus lines replaceable by DRT is notably low, underscoring the viability of replacing routes with lower demand. In the context presented in this paper, DRT is almost always not profitable, however, the combination of higher fares and reduced associated costs results in significant savings for selected routes in comparison with bus transport. This implies that DRT can be a

viable option as a bus replacement, especially in areas with low demand or during off-peak hours, aligning with the findings of Mortazavi et al. (2023). However, this significantly depends on passenger counts, and sudden peaks can pose a challenge. The utilization of larger vehicles through advanced transport booking could effectively address this issue.

5 Conclusions and Policy implications

This study proposes a novel framework for evaluating the feasibility of implementing DRT transport in a specific region and applies it for the Košice Self-governing Region. The methodology involves agent-based model to predict costs and revenues for DRT transport through distance and demand matrix, to calculate occupancy and distance travelled for DRT vehicles. The costs and revenues of DRT transport are then compared with those of fixed-route bus service, considering the higher willingness to pay for DRT transport. In addition to cost comparison, profitability is also assessed to determine whether DRT implementation is economically feasible. A separate comparison of each route is proposed since it is not expected that replacing all bus transport with DRT would be possible or feasible. Therefore, DRT should be considered as an additional integrated transport service within public transportation systems, with the aim of reducing government subsidies while maintaining or enhancing accessibility wherever feasibility is established.

To test the applicability of the proposed framework, we conducted a case study on the Košice Self-governing Region in Slovakia, using the data from one standard day. The results indicated that even after implementing DRT transport, the majority of routes remain unprofitable. While the achieved cost savings were not consistently substantial and some DRT routes exhibited considerable losses, it is noteworthy that DRT outperformed fixed-route bus transport in 31% of cases. These superior outcomes were predominantly observed in low-demand areas and during off-peak hours suggesting the usability of DRT vehicles. However, it is essential to acknowledge that as demand escalates, the efficiency of traditional bus services experiences a notable upturn, whereas the efficiency of DRT starts to diminish. In a long term the savings could be even bigger, because a portion of the subsidies provided to private carriers is allocated for the renewal of their vehicle fleet and this cost could theoretically be avoided in the case of DRT. Therefore, our framework could be considered as a viable option for municipalities looking to reduce transportation costs and increase efficiency in their public transport systems. By rigorously evaluating each bus line for replacement, decision-makers can pinpoint routes where DRT offers substantial economic advantages, balancing the need for cost reduction with the commitment to maintaining high-quality service. Pilot programs should be initiated to test the feasibility and public acceptance of DRT on select routes, providing valuable insights to inform broader implementation strategies. Moreover, seamless integration with existing public transport options should be embraced to ensure DRT remains a viable and cost-competitive alternative while effectively addressing high subsidies for public transport in the region.

This paper has several implications for the improvement of rural transportation systems. First, it demonstrates that DRT can be integrated into the existing fixed-route bus transport system in rural areas to reduce costs and increase accessibility. Second, it provides a scientific framework and a simple agent-based model to evaluate the feasibility and performance of DRT for each bus route. Third, it offers insights into the conditions and factors that affect the viability of DRT, such as demand, occupancy, fares, and subsidies. Fourth, it contributes to the literature on DRT and rural transport by applying the framework in a case study of a rural region in Slovakia.

However, it is important to note that the study has several limitations that may affect the generalizability and validity of the results. For instance, the price assumed stable demand and included DRT costs in the prices of private carriers, which may

impact the results. Moreover, further research is necessary to evaluate the long-term benefits and drawbacks of implementing DRT transport in different regions with varying transportation needs and demographics. Despite these limitations, the framework provides a valuable tool for decision-makers to evaluate the potential benefits and drawbacks of implementing DRT transport in a given region.

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THE PREDICTION OF THE DEVELOPMENT OF THE WORLD POLITICAL-ECONOMIC DISTRIBUTION OF FORCES BASED ON THE POSITION OF THE WEAKENING ROLE OF THE US USD AS A GLOBAL RESERVE CURRENCY

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Abstract: After 2020, many countries claim a dominant position or serious participation in global politics. In monitoring the development of macroeconomic indicators, especially from the point of view of forecasting their development with regard to the direction of the globalized political-economic trend, one can look for the future of the world order. The combination of factors reflects the conflictual and complex nature of development, pointing to areas with high demographic pressure. The expansion of the sphere of influence of NATO and the European Union in the former Soviet republics caused great resentment in Russia. Russia, on the other hand, is trying to create a Eurasian bloc with a strong Orthodox core, but also with considerable influence in relatively weaker Islamic countries. The aim of the contribution is to predict the future development of the world's political-economic distribution of forces based on the position of the weakening role of the US dollar as a global reserve currency.

Keywords: Reserve currency, globalization, international order, ideology, bipolar world, political-economic view.

1 Introduction

The problem of the political-economic balance of power lies in globalization. Economic globalization is inherently transnational and removes all barriers to the movement of goods and capital. In international politics, however, we encounter an emphasis on the concept of the nation state. Thus, the organization of peace is greatly influenced by the alignment of concepts of national interests, and thus the emphasis on the importance of borders. (Kissinger, 2016) It can therefore be concluded that nation states remain the main actors and the main motivation is the acquisition of power and wealth, emphasized by cultural orientation in all its similarities and differences. Henry Kissinger (2016) lists six major powers that will continue to assert their own values in the future. United States, Europe, China, Japan, Russia and India. Huntington (2001) bases this classification on the civilizational model and adds that there are five very different civilizations. In order to complete the whole issue, Islamic countries cannot be neglected. Their total population, strategic location, underground sources of oil and gas, and influence on world politics are not negligible. (Kissinger, 2016)

In the early 2000s, it became increasingly clear that the new American economy that had been created in the last 15 years had many serious shortcomings:

- The huge financial obligations that had been spent over the years to develop this economy were hanging in the balance;
- The growth rate did not correspond to the expected values;
- This "high-tech economy" requires more and more investment for its mere existence;
- And above all, it does not allow a significant increase in sales to its consumers, as it turned out that the consumer is relatively conservative in his needs (clothing, housing, food). The analysis of the structure of the population's expenditure also showed that in order for the share of the population's expenditure on GDP involved in the purchase of goods produced by the "top economy" to increase by at least 1.5 %, the need for investment in the economy itself would have to almost double. (Cheung, Kutcher, and Wagle, 2009)

Eventually, however, US resources proved insufficient to sustain the "high-tech economy" and the scale of the financial problems spread to the rest of the world. America helped revive the European economy, created the North Atlantic Alliance, and

created a network of global and economic partnerships. It set up a worldwide system of free trade that helped increase shared prosperity and productivity. (Kissinger, 2016) The history of economic relations throughout the world is based on a single measure of value, with gold being the measure of value for most of the time. It was only in 1944 that the US dollar, which was backed by gold – the Bretton Woods system – took over as the standard of value. In 1971, this system was abandoned and the US dollar, which was backed by the US economy and political power, became the sole benchmark. America needed markets and developed them further. From 1945 it lent to Europe, then created the WTO to define a controlled market and protect the interests of big corporations, including the aforementioned wars in the Middle East, Afghanistan, Vietnam, Africa, Korea and elsewhere, which of course invalidated the aforementioned ideologies. (Clark, 2003) However, in the 21st century, there are no longer enough resources to keep everything together indefinitely, leading to what is happening in the world now. The more Americans will resist this, the more enormous the consequences, both economic and political, will be. (Eckert, 2012) However, the free movement of America to the East was always hindered first by Tsarist Russia, then by the USSR. This was followed by its long departure from the political scene, but at the beginning of the 21st century, Russia returned to a state where he had to be reckoned with. The Russian stagnation that lasted from 1986 to the beginning of 2000 is now over. Russia is trying to show the world that it is in full force, and what it is. The Soviet Union thus became a guarantor against NATO's eastward advance, as it firmly established itself in territories that had previously belonged to Europe. In this way, it maintained stability in these territories and prevented the US from advancing east, not only to the borders of Russia, but also to the borders of other countries and influencing them by force. In 1989, the Berlin Wall fell, which was the beginning that gave free rein to liberal US policy, which went east and pursued its economic and political goals regardless of the interests of the countries present, and the gradual destruction of the bipolar world began. After that, Russia very quickly left the world stage. The agreement that the United States made with the Soviet Union in 1990 that NATO would not move eastward was broken, and America began deliberately moving NATO in that direction. Subsequently, America destroyed the economies of those countries that became part of Europe. (Brzezinski, 2007)

The Baltic states, which were integrated into Europe and the WTO, lost their entire economy and became only a donor to the European Union. Later, in 1999, there was an unprecedented destruction of Slovenes in Belgrade. The US pursued its strategy of political and economic dominance through NATO. Russia, which has always defended Europe, allowed the destruction of the Berlin Wall and allowed the US to expand its sphere of influence eastward, destroying the stability it had created. As NATO moved closer to Russia's borders, it eventually led to the conflict in Ukraine. (Historical Retrospective, 2022) (Nezavisimaya Gazeta, 2019) (Pechurov, 2018)

In the period after World War II, the United States of America (US) and later the European Union adopted rules and principles for the free movement of goods and capital, the rejection of the use of military force among its members, and the military-political hegemony of the US, where the US is the main guarantor and distributor of resources and all benefits. When the bipolar system ceased to exist, all previously established rules and customs began to merge with the global UN system, leading to the establishment of a liberal world order. From the very beginning, the characteristic leadership of the US and its allies, especially the European Union, came into conflict with the formal equality of states within the UN, as well as with the status of Russia and China, which were not part of the political institutions of the West formed throughout the Cold War. (Huntington, 2001) The global interdependence of countries,

which has been building for decades, is becoming more and more tangible for states, companies, and citizens and we are now witnessing a change in progress. There is an intensive restructuring of economic relations, which undoubtedly leads to a gradual weakening of the USD as the dominant currency. (Wallerstein, 2016) Against the backdrop of general economic and political changes, financial and economic hegemony is weakening in the US. There is a reluctance to have strong competitors abroad, disrupting the economic and financial rules that have worked in the market for many decades. Eliminating the dominance of the USD can be achieved by transforming the current world monetary system and creating new global regional currencies and international financial centres that will contribute to a multipolar arrangement in the financial sphere. (Zakaria, 2010) The US has repeatedly used mechanisms to regulate the access of foreign companies to domestic financial markets in various countries as an instrument of foreign financial policy. And this mechanism is now losing its power. The IMF is also an instrument of US foreign policy that supports US hegemony. (Wallerstein, 2016) The world monetary system is highly dependent on the US dollar and this is bringing it to the point of crisis. (Eckert, 2012) The debt crisis (Stroukal, 2021) of the United States of America reflected in the devaluation of the US dollar can have a very negative impact on most of the world's economies because their foreign exchange reserves are denominated in this currency. This again highlights the role of China and its Yuan, which immediately displaced the Japanese yen and the British pound upon its acceptance into the SDR (Special Drawing Rights – constitutes the main reserve asset of the IMF) basket. Another consequence is the depreciation of the euro. All these key points lead to the creation of a strong argumentative plane for outlining the further development of the global direction of the world economy and the new distribution of the new centres of power of the world political order.

2 Problem processing methods

The paper deals with a comprehensive historical analysis of the role of the US dollar (USD) as a key instrument of the power and influence of the United States of America in the global economy. The historical development of the USD and the Federal Reserve System (FED) is examined in detail, including an examination of the Bretton Woods system and its influence on the formation of the global financial order. A comparative political-economic analysis of various political and economic strategies of states towards the USD, their motivations and impacts on the global economy is used in order to identify key differences and similarities in their approaches and impacts on the global economy. Empirical data and statistical methods are used for objective assessment of current and historical trends. The approach makes it possible to bring new knowledge about macroeconomic indicators and their influence on global political-economic dynamics. Theoretical framing and critical analysis uses the theoretical foundations and opinions of leading economists and political scientists, combined with a critical assessment of alternative economic approaches and theories. The views and theories of prominent economists and political scientists such as Henry Kissinger, Daniel Eckert, Jaroslav Kurfürst and Josef Jílek are interpreted and confronted with alternative approaches in economics, drawing on the works of authors such as Michael Morris, Karlheinz Deschner, H. H. Will and the Šlapota brothers. Deviations and specific trends in economic thinking will be identified, which allows to provide a comprehensive and balanced view of the dynamics of the global economic environment. Analysis of trends and future scenarios is aimed at exploring and predicting future trends, including the potential shift away from dependence on the US dollar and the development of alternative economic and monetary systems.

3 The rise of the USD as the global reserve currency

The beginning of the American USD is associated with great inflation. The original currency of the United States of America was called the Continental. This money was issued on behalf of the Continental Congress in the 1770s-1880s. However, their form was paper and they were primarily intended to fight against

the British colonialists. (Jílek, 2013) The beginning of the linking of the dollar with gold and silver dates back to 1792. However, later, in 1879, there was a shift from bimetallism to monometallism, and the dollar was no longer covered by these two metals, which represented a significant step in the economic development of the United States. These moments were important for the gradual profiling of the USA as the successor of the great power of the 19th century – the British Empire. Another milestone for the process of appreciation of paper currency was the law of 1873 (Coinage Act), in force 1879. The value of the US dollar was fixed against an ounce of gold. Thus, the USD was as good as gold until 1971, when the linkage was abolished by President Richard Nixon's decision. (Eckert, 2012)

The Federal Reserve Act of 1913 was the culmination of the United States' historic effort to create a central bank known as the Aldrich Plan. The Fed, the Federal Reserve System, has been composed of the Federal Reserve Board and twelve regional reserve banks since 1913, this system introduced the concept of an elastic currency. The ban on gold exports during World War I disrupted the gold standard regime, in place between 1879 and 1933. The Fed was charged with the responsibility of placing bonds and repaying them when they matured, bringing in \$21.5 billion for the federal government. The critical value was already reached in 1920, when the ratio of issued banknotes and gold reached a minimum of 40%. Higher discount rates stopped this phenomenon at the cost of a recession. The Great Depression saw the failure of more than 11,000 banks in the US, and even in 1933, all banks in the country were closed for 4 days by President Roosevelt. Unemployment reached 32% that year, up from 3% in 1929, and bankers and brokers were blamed for their dishonesty.

The historical transition from a rather deflationary development valid until 1940 to inflation is linked to the state of war. Another factor is the withdrawal from the gold standard in the 1980s to the level of 14 %, or in the event of a pandemic in 2022 with 8 %. GDP growth can be traced from \$0.1 trillion in the 1930s to \$23 trillion today. In addition to the standard management of inflation using the real interest rate, there is a drastic increase in the country's indebtedness. The 1980s are a watershed and I demonstrate the dark side of debt to US GDP growth. From World War II to the 1970s, the FED was focused exclusively on economic growth. Controlling inflation with the help of the interest rate only came into focus in the following period, but deflation was named as a clear threat. (Jílek, 2013) In the area of indebtedness, the Fed's quantitative easing implemented since 2007 is highlighted, when the value of American government bonds in its ownership in 2022 was already 12.26 trillion USD. Among the largest foreign holders of US Treasuries are Japan with USD 1.08 trillion and China with USD 870 billion of US bonds. The rise of the USD is identified with World War I as a period of weakening of the British pound, thanks to Great Britain's debt to the value of twice GDP in the 1920s and Churchill's erroneous decision to overvalue the pound to the level of 4.86 USD, which had disastrous consequences, since at that time already because the USA was outdoing this country with its predatory economic policy. The main goal of the Bretton Woods arrangement in 1944 was to establish the USD as the main world currency, to fix its value at the level of 35 USD per ounce of gold and to maintain parity by the issuing banks on the foreign exchange market in a maximum fluctuation of 1 %. (Eckert, 2012) The system can be assessed as very solid, even with problems stemming from the financing of the war in Korea, the power ambitions of Communist China, or the Cuban crisis. At the end of the 1960s, the era of the gold standard brought the first doubts about the maintenance of the hegemonic position of the USA. The conflict in Vietnam, the economic prosperity of Europe and the associated exchange of USD for gold led by France and subsequently the attack of exchange rates by speculators could no longer be handled by the Bretton Woods system. (Wille, Šlapota K., Šlapota B., 2020)

Paradoxically, it was Japan that played a key role in saving the situation after de Gaulle's attack on the American monetary system. The inability to regulate the price of gold and the

loosening of the USD exchange rate against major currencies has definitively changed the functioning of the world economy. However, the fall of the Bretton Woods system was not so unpleasant for the USA. After the collapse of the Bretton Woods system, the US maintained its status thanks to the USD's position as an international currency, with dollar bills becoming the bonds in demand worldwide. (Eckert, 2012) In the next period, however, America issued banknotes as needed and spun an inflationary spiral, when inflation values reached double-digit values. The dollar continued to significantly lose its value and was not helped by the circumstances of the 1980s, i.e. the abolition of the ban on private acquisition of gold, but also the second oil crisis. The phenomenon of demon dollars arose, i.e. money created from US loans, which were intended primarily for investment. The negative effect of their inappropriate value compared to goods or services was fully manifested in the 1980s in Japan and later moved to other "bubble economy" countries. The saving grace of the whole situation is primarily the FED, mainly thanks to quantitative easing. The 1990s were marked by a reduction in the growth rate of the federal debt, with President Bill Clinton's administration even halting debt growth. The year 2001 stabilized the debt value at 57 % of US GDP. (Jílek, 2013) Since 1999, the Fed began to significantly increase interest rates to prevent the economy from overheating. From 2001, there was a drastic reduction in order for the Fed to face deflationary tendencies, and subsequently from 2004, it returned to increasing again, reaching a value of 5.25 % in 2006. (fiscaldata.treasury.gov, 2023)

Between World War II and the late 1970s, the Fed primarily stimulated the economy and did not address inflation with due attention. It was only during the following period that the Fed turned its attention to inflation. In 1997, there was even an increase in the interest rate even at a time of falling inflation, and in his official communication from the same year, the chairman of the Fed declared that the main threat to expansion is deflation, not inflation. From late 2007 to 2011, the Fed implemented a process of so-called quantitative easing by increasing its holdings of federal bonds to the level of \$1.750 billion; \$848 billion in mortgage-backed securities and \$108 billion in government-sponsored agency bonds, all at favourable interest rates. This brought with it a 13 % increase in GDP, higher employment, but also an increase in federal taxes. Today, the Fed is the largest owner of US federal bonds, surpassing China and Japan. Quantitative Easing was ended by the Fed in 2014 and the value has stabilized at USD 2.5 trillion in Treasury bonds. Mainly maintaining a low interest rate appeared to be beneficial, and with the help of loans created out of thin air, it buys government bonds from member banks. By doing so, it substitutes money printing and helps the government avoid penalties for high interest from excessive indebtedness. Since 2020, the Fed has announced the purchase of an additional \$500 billion in US Treasury bonds, as well as \$200 billion in mortgage-backed securities, to support the economy during the pandemic. In April 2022, the Fed already owned 12.26 trillion USD in US government bonds. (thebalancemoney, 2023) The final finding for assessing the future state is the statement that 60 % of US government loans are in foreign hands. However, these bonds are long-term and their debt relief is aided by inflation. The 5 % limit maintained by the Fed thus provides the basic premise of maintaining the dollar's position as an international reserve currency. Only hyperinflation could disrupt this change. Then it will be necessary to look elsewhere for a replacement.

4 The influence of the USD on the reorganization of forces in the international political and economic world

The America proclaims very emphatically its country's status as a leader in world affairs. This position was started by the events of the period after World War II. The market share of this country's economy in the global economy reached 60 %. The main driver of this success was the flourishing of the arms industry in the Victory program and, in particular, the massive investment reaching 44.8 billion USD by American concerns in Europe. Another support mechanism for the sale of American products was the provision of the Marshall Plan of economic aid,

awarded in 1953 with the Nobel Peace Prize. The Marshall Plan was implemented, even with its unnamed consequences in the form of gaining new outlets in place of the lost Chinese markets associated with Mao's revolution. In its quest to secure extraordinary economic and military influence in Europe, the USA finds a new enemy in the communist USSR. (Deschner, 2016) This period, the Cold War, can be translated into rivalry in the form of a series of proxy wars, as it was in Korea and Vietnam, and continues to be, for example, in Ukraine. Three times the US has withdrawn from war due to poor preparation or a lack of transformative engagements. Iraq and Afghanistan were terminated by the President and Vietnam by Congress. America faces the moral dilemma of whether it pursued unattainable goals or pursued a strategy that failed to achieve. (Kissinger, 2023) The military interventions of the United States have always brought with them a fundamental restart of economic growth supported especially by a strong military-industrial complex. The country's influence is underlined by its participation in NATO in 1949, including the consequences of its expansion, and the role of the CIA since 1947 for the protection of national security, which sounds tendentious in retrospect. (Kissinger, 2016)

The fact is that after the fall of the Soviet Union, America once again found a new enemy, this time in the form of Arab terrorism, and crowned its efforts by participating in the wars in Iraq and Afghanistan. The proclamation of democratic processes in the Arab environment rings hollow, but the profitable contracts of the military-industrial sector amounted to an estimated 2 trillion USD. Lockheed Martin, Northrop Grumman, General Dynamics, Boeing and others can be named. (Lopata, Tichý, Slivka, 2023) The US has interests in the oil fields in Iraq or opium cultivation in Afghanistan. The increase in defense costs is very strongly linked with each war started and there is a steady increase to the extent that today the United States invests 877 billion USD compared to 14 billion USD after World War II. The phenomenon is the merit of Donald Trump with the achievement of the lowest historical level of unemployment of 3.7 % in 2019 after the tax reform with the negative consequence of increasing social inequality and the negative effects of the fight against COVID-19 during the Biden administration with an investment package of 1.9 trillion USD.

There are three threats to American hegemony. Europe, Russia and China. Europe is losing with its disunity in common defense and military policy. Moreover, economic dependence on the US increased after the 2008 crisis. Russia, after significantly improving its economic situation after the Yeltsin era, was significantly weakened after the invasion of Ukraine, both due to the conduct of a protracted war and the impact of sanctions from the free world. The main focus is on China, where its economic boom can be predicted, with the vision of controlling 50% of the global economy by 2050. In response to this fact, America is trying to assert its influence both militarily, e.g. by building bases in Australia, and also by economic rapprochement with countries such as Japan, Thailand, Vietnam, South Korea, Singapore, Malaysia, Indonesia. A separate chapter is Taiwan with the stalemate and Myanmar. There is a gradual reorientation to the issue of Latin America caused by the changing demographic environment of the US. The African continent can already be declared as China's sphere of influence. The Middle East, de facto the entire Arab world, is becoming another area where spheres of influence are being formed and the ongoing Israeli-Palestinian war complicates the whole situation. (thediplomat.com, 2023)

China steadily strengthens its military, now the third largest, and expands its influence by investing in the economy. It invests in the construction of deep-sea ports in Myanmar, Bangladesh, Pakistan and Sri Lanka, mainly for the distribution of oil and gas. In African countries, they are interested in precious metals and minerals, and in return they help build infrastructure in countries such as Kenya, Angola and Ethiopia. A potential risk is the fact that China's economic power is based on the global economy. If no one buys from China, there will be a chain reaction of economic weakening ending in a potential threat to

the entire regime. Asia is interwoven with a spectrum of multilateral groupings and bilateral mechanisms. In some key groupings, the USA is also a member, others are also economic, they are purely Asian. China believes in its uniqueness and in being closed to its own reality. America considers itself unique, exceptional, but with a moral obligation to spread its social values in the world. Thus, the order of the 21st century will take place either in the form of mutual rivalry or in the form of partnership. (Kironská, Turcsányi, 2021)

America's aid to Japan after the World War II was lost. Wars and the country's rebirth as a military powerhouse with \$40 billion invested in defense were aimed at limiting China's regional influence. Approximately 30,000 American troops were stationed on Japanese soil and remain there today. The constitution began to bend in the 1980s, and the self-defense forces became a modern combat unit. The Americans, taking into account China's regional importance, ignored this process. After 2000, it was already possible to fight alongside the allies. (Marschall, 2018) However, the economic growth of the country, once the fastest growing economy, started to slow down along with the trend of significant population reduction. Analysis of the future state highlights the continued strained relations with Russia, especially over the Kuril Islands. (Kissinger, 2023) The next step is gaining new allies, such as South Korea. There is growing tension in the relationship with China, not only due to the dispute over the Ryukyu and Senkaku/Diaoyu Islands, but especially in the promotion of American influence in the region.

The influence of India, as the most populous country in the world, creates a certain potential for tomorrow, even if the current GDP is only 20 % of China's. The country has vast areas of arable land and has sufficient water supply. It is a major producer of coal and natural resources. In the international field, however, India functions rather neutrally. It is even more focused on a traditional problem, Pakistan with its nuclear weapons. (Kissinger, 2023) In the relationship with China, there is a power struggle for influence over Tibet, Nepal, Bhutan and Arunachal Pradesh. (Kissinger, 2023) The country internally faces separatist attacks by the Sikhs or the state of Assam. Thus, the future state of the country will shift to strengthening relations in the region, with countries such as Myanmar, the Philippines and Thailand, Vietnam and Japan. The United States also offer assistance, and India, although it has a well-armed navy, including an aircraft carrier, may accept such assistance in an expected power struggle with China. However, the biggest threat to India remains the Muslim world. We cannot ignore the fact that the country is inhabited by the second largest Muslim community after Indonesia, and all unrest is covered by an approach to minorities, support of common internal political principles, including national pride and democracy, and thus rise above the contradictions within the communities. With Pakistan's current position and the radicalization of the Arab world, the country has to make a lot of concerted efforts to resist these pressures. (Kissinger, 2023)

Russia has always been very attractive, especially due to its wealth of raw materials. After the October Revolution, there was an increase in the country's economic level and foreign policy, similar to the previous analysis of the USA. It can be stated that the country that distinguished itself as a victorious power and liberator during World War II soon became a key player in the bipolar division of the world during the Cold War. (Wille, Šlapota, K., Šlapota, B., 2020) The naive political actions of the Gorbachev era leading to the collapse of the USSR and de facto led by the powerful interests of the Western global economies significantly damaged the state of the country. The collapse of the USSR was a geopolitical change of a global scale. (Marschall, 2022) The fall of Russia was exacerbated by the rise of Boris Yeltsin. His government bankrupted the country and the oligarchs took their huge cash profits abroad. It is necessary to focus on the country's most valuable commodity, oil, and especially the incredibly disadvantageous deals with Western investors and the ecological damage in the country. The arrival of President Putin reversed this situation in the country. Reducing inflation and increasing nominal wages achieved a 30-

fold increase in wages and a 9 percentage point reduction in inflation during his administration. (Laqueur, 2016) GDP has also more than doubled in the country. Russia's image is damaged, especially by its military interventions in Ukraine, Chechnya, Syria and others. Despite the fact that the Russian army boasts the status of the second strongest in the world, strategically, the country faces many obstacles. The annexation of Crimea does not solve anything, because the exit from the Black Sea is controlled by Turkey. Gibraltar and Suez also stand in their way to the Atlantic. Investments in military capabilities and technological development will be key to maintaining its status as a military power. The future of Russia in the international context will thus significantly depend on the development of its relations with the West, the ability to adapt to economic and political challenges, and the success in creating new alliances and partnerships outside the Western sphere of influence.

The democratization processes of the Arab Spring soon brought, as in the Syrian case, the level of crystallization of tensions between the main Muslim groups of Sunnis and Shiites. (Kissinger, 2023) In the Palestine-Israel issue, it is necessary to map the historical events since 1917 and identify the key political milestones associated with the Jewish state in the Arab world. Unfortunately, tensions in the region continue even now, due to the ongoing war. The attitude of the international community to this situation is different. (BBC news, 2023) The US, European Union and other Western nations have condemned the attacks by Hamas, and the US is pledging further support for Israel, including military equipment and strengthening its naval presence in the eastern Mediterranean. Russia and China are reluctant to condemn Hamas and maintain contacts with both sides of the conflict. Iran, as a regional power, continues to support Hamas and Hezbollah, another enemy of Israel in the region. (Reuters, 2023) Saudi Arabia is a key country of the Sunni conception of the Muslim faith, and thus Iran's arch-rival. The country is particularly interesting from the point of view of its oil deposits, which are the second largest in the world. (Kissinger, 2023) Saudi reserves are thinning and have already fallen from 737 to 475 billion USD, which led the Saudi prince to adopt a "new Vision 2030", aimed at diversifying the economy towards the technology and service sectors, with a plan to invest in this program 5 % of shares from the sale of Saudi Aramco. (Marschall, 2022) The country tries to develop projects like the futuristic city of Neom and invests in the green economy and electric cars. Strategically, Saudi Arabia maintains a partnership with the US and develops relations with China, until recently it was even willing to reassess relations with Israel, especially for business reasons. A potential alliance between Saudi Arabia and Russia may affect global oil prices, but will be complicated by geopolitical tensions and differences in regional interests. (Washington Institute, 2023) On the other hand, Saudi Arabia tries to diversify its international relations and reduce its dependence on the US, while Russia is similarly strengthening its influence in the region. India is also becoming an important trading partner of Saudi Arabia, but its relations with Iran and Pakistan complicate the possibilities of a deeper partnership. Therefore, the United States can be expected to remain a key security guarantor and trade partner for Saudi Arabia, and its support will be critical to the success of the Vision 2030 reform agenda. Any future alliances with Saudi Arabia must therefore carefully consider these existing relationships and strategic interests. (Atlantic Council, 2020)

Iran has the world's fourth largest oil field. After the World War I, it immediately attracted the attention of the British, who were protecting the interests of their British Petroleum. The same scenario was repeated after the World War II and the United States and the USSR intervened in the situation. (Marshall, 2022) Since 1979, however, the country has been situated in the form of an Islamic republic under the leadership of ayatollahs. It is necessary to draw attention to the unauthorized Iranian nuclear program, which puts the country under the pressure of Western sanctions. Iran's future will be heavily influenced by its relations with China, the US and Russia. China is emerging as a key investment partner as the U.S. under the Biden administration

considers a shift in policy toward Iran's nuclear program, a decision that could finally lead to the easing of sanctions. At the same time, Russia is strengthening its influence in Iran, which may complicate relations with the West, while demographic changes and the growing demands of the young population create pressure for social and economic reforms.

5 The future of the international arrangement

The By historical separating of the USD from gold, from the point of view of its position as the core of the international monetary system, the USD represents a bond whose strength rests on the success of promoting American values in the world. However, American consumption is very heavily dependent on other loans, liabilities and bonds. The current trend is accompanied by the weakening of positions by the retirement of strong cohorts and the reorganization of the concentration of the economy around China. The economic trend shows only further indebtedness, and we should look for a way out of this problem in controlled inflation. The advantage of inflation is the deleveraging of the country, since the majority of bonds have a long maturity and are held by non-Americans, so the impact will mainly go to other economic powers. The exchange rate between the American and Chinese currencies is key, as it is the exchange rate that determines the movement of trillions of USD, either to Western economies or to the expanding Chinese economy. The EU also figures in the game, whose production is comparable to China with less than a third of the population. In 2022, the US GDP reached 25 trillion USD, compared to China's 18.1 trillion USD and European 15.8 trillion USD. However, the EURO represents a defensive currency and could serve as a calm point between the phase of the retreating USD and the rising yuan. The rise of China and Asia is inevitable and the USD, Euro, Pound are just bonds, but less covered every year. In the recent past, the government has tried to prevent deflation with stimulus programs and the central bank has used quantitative easing to influence the market. The goal was to start economic growth, but it only succeeded in preventing further decline. The West greatly underestimated the whole situation and assigned the whole situation the status of hermetically sealed capitalism with a lobbyist approach and missing control mechanisms. The demon USD crisis will be treated with new demon USD backed demon euros, pounds and yen held in overvalued Treasuries. You can get out of this spiral through the state bankruptcy of several large countries and the associated depression, or hyperinflation with the expropriation of loan holders. It is quite obvious that the international gold standard will not be restored in the foreseeable future, but the role of real values in the areas of investments and pension insurance is being strengthened. In the area of paper money, in the coming years, currencies that will emerge from economically dynamic and low-indebted countries, countries rich in raw materials, with good prospects for an upward trend and a healthy demographic structure will begin to gain ground, and the yuan appears to be the most suitable. For international currency needs, China, as the future number one player, manipulates its currency, giving it a huge export advantage. On the other hand, the yuan is not suitable for storing values, where the currency is expected to be reliable, solid, flexible and tradable. Another supporting argument is the worldwide decline in the proportion of liberal democracies from 18 % to 13 % since 2012. Also, the share of the global economy from the original 74 % of global GDP in 1998 is currently 47 %, comparable to the economy of autocratic systems such as China or Russia. Russia is a country that is demographically aging, the country's income is fundamentally based on oil and gas income, and the future of the country is therefore completely dependent on them. Favourable points for economic growth are the existence of the Eurasian economic sphere and BRICS. The BRICS group has already surpassed the Western G7 group, as the BRICS countries account for 32 % of the world's GDP, while the G7 group of countries only accounts for 30 % of the world's GDP. China's New Development Bank further expects BRICS to expand to include Arab oil and gas exporting countries, namely Saudi Arabia, the United Arab Emirates and Iran. Thus, by 2030, the BRICS bloc of developing countries will account for 50 % of all worlds GDP. Russia also supports the use of the Chinese yuan in

trade with Asia, Africa and Latin America, weakening the dominance of the USD. It is quite obvious that the United States, by using the USD to impose sanctions and control the world economy, especially its confrontational attitude towards China and sanctions towards Russia, has accelerated the effort to diversify away from the USD on a global scale. The central banks of Russia and China hold fewer and fewer USD reserves, while most of their trade with each other is conducted in yuan. While the global economy still needs the USD for its tradability and stability, there are efforts to create alternative payment systems, including oil trading in yuan and experiments with digital currencies. These steps show that states are willing to support their political goals even at the cost of high economic costs. The disadvantage of gold and silver in the position of a possible alternative to the dollar or another strong currency is, for example, the regulation of production, but the fundamental finding is that with a real gold standard, gold, or silver to cover the weight of money. It would not be enough for, for example, the amount of money in the Eurozone to be covered by only 2-3 % of gold bars and coins. Gold money would have to be covered by at least 40 %. At current prices, all the gold stored in the countries of the monetary union will cover 100 % of only 333 billion euros. However, the total funds are estimated at 9.4 trillion euros. In such a case, they would only be covered by 3.5 %. So the amount of money can be radically reduced or the price of gold can be increased enormously. In both cases, it is an economic shock. The current trend in this case is thus towards the privatization of gold reserves and further manipulation, thanks to the derivatives market, of the price of silver.

6 Conclusion

The contribution contributes to a better understanding of the role of the US dollar in the global economy and its impact on international relations and financial policy, helps to deepen the understanding of the future development of the international financial system and monetary policy. The struggle for world hegemon is apparently an icon for all ideologies, religions, politics of the world. On one hand, we talk about liberal democracy as an ideal to which all the countries of the world should approach, and on the other hand, on a mass scale, individual countries are turning in different directions. It is clear that this is not just a simple political act, but brings with it a shift of economic power in favour of various forms of autocracy. Russia, as a remnant of the Soviet Union, represents the main military threat, but the strength of the country is reflected in the determination of the population, the energy potential and the ability to face the Western perception of the world. Another variable is China, which is "the" main challenger. Patient effort has produced a real economic threat in a very short period of time, not only to the United States, but to the entire world. The American dollar, representing the Western democratic system, is losing its dominance and the centres of the economy are moving in alternative directions.

The United States repeatedly proclaims its status as the world's number one hegemon through the mouths of its presidents. Its power is primarily based on its military-economic strength. Under the auspices of the global spread of democracy, it gains fundamental influence over individual countries. Here, it tries to create long-term markets for its products and obtain raw materials that help improve the performance of the domestic economy. We repeatedly compare the gross domestic product with other factors that help to understand this trend. It clearly shows an increase in economic growth, but a significant link to indebtedness. The fact is demonstrated that if this growth declines, there is still the possibility of resuming the decline through military conflict and the country's involvement in a war economy. This ratio of profits of the military-industrial complex is demonstrated empirically. The ratio of economic growth in China and the United States is compared, where the mutual ratio sounds very unfavourable for the United States. A new player is emerging on the scene, the BRICS. The lessons of the US imposing tough sanctions on Russia through the central currency of the US dollar sound like a cautionary tale for contenders for world power. The answer has been attempts by China, Russia

and the Europeans to build an international fire system outside of the US dollar. Arab countries trade their oil in yuan, followed by India when it comes to Russia.

Regarding the forecast of the distribution of political and economic forces in the world as a result of the weakening of the role of the US dollar, we can state that there will not be a significant turn in the near future. This represents the continued leadership of the United States, represented by the strength of the US dollar on the world stage, as well as a significant military effort to maintain energy supplies and markets for its exports. America, with its global economy and presentation of its values, creates the need for consumerism. The United States repeatedly proclaims its status as the world's number one hegemon through the mouths of its presidents. Their power is primarily based on their military-economic strength. Under the auspices of the global spread of democracy, they gain fundamental influence over individual countries. Here, they try to create long-term markets for their products and obtain raw materials that help to improve the performance of the domestic economy. In our texts, we repeatedly compare the gross domestic product with other factors that help to understand this trend. It clearly shows an increase in economic growth, but a significant link to indebtedness. The fact is demonstrated that if this growth declines, there is still the possibility of resuming the decline through military conflict and the country's involvement in a war economy. This ratio of profits of the military-industrial complex is demonstrated empirically. The ratio of economic growth in China and the United States is compared, where the mutual ratio sounds very unfavourable for the United States. A new player is emerging on the scene, the BRICS. The lessons of the US imposing tough sanctions on Russia through the central currency of the US dollar sound like a cautionary tale for contenders for world power. The answer was attempts by China, Russia and the Europeans to build an international payment system outside of the US dollar. Arab countries trade their oil in yuan, followed by India when it comes to Russia.

With its offensive policy, the United States of America suppresses the fact that the current US dollar no longer represents its original strength and thus loses its sphere of influence. The USA has represented the real hegemon of the world order since World War II. The effort of all US presidential administrations is to maintain the primacy of world hegemony with its positive and negative consequences. Securing global peace through disproportionate military interventions means that the country's economic growth is superior to anything in the rest of the world. Analysing Russia, one can understand the weakening of this country in Yeltsin's times into a country looking for its original strength. This stems mainly from the union of the anti-sanctions world in the form of the aforementioned BRICS complex, from which China benefits the most. An analysis of China in the form of global investment expansion leads to worrying results. China offers a very interesting construct to the American arrangement, and its economic growth is multiple compared to other states in history. However, China has learned its lesson and is keeping its currency low so as not to repeat the examples of the Asian tigers. China, with its protective tendency to undervalue its currency, greatly supports exports, but a manipulated currency is not suitable for preserving values. The analysis of the potential of other countries clearly highlighted the real possibilities of Japan and India or of the Arab countries, especially Saudi Arabia and Iran, but they cannot be counted on to become a contender for the hegemon of the world. However, we are not underestimating their energy, population, i.e. market and productive potential. The hegemon position of the United States of America in world politics and economics will be threatened by China's economic boom and Russia's resource wealth, as well as whether Russia can demonstrate and sustain its imperial ambitions. The trend of the USA and, always behind it, the EU and China, has so far shown progressive tendencies. The game of Chinese economists with the currency and its undervaluation is also very significant. However, the effort is to highlight the fact that China, second only to Japan, owns almost 900 billion USD in government bonds. However, China needs resources for its epoch-making

expansion. Its need for oil and gas and its coverage, the second largest in the world, is pointed out. Europe has completely absorbed itself in green politics and is boldly liquidating its industrial strength within the framework of the ideology. The Arab countries are fighting the Western Satan as part of Jihad. As in the case of the Afghan war, Russia allowed itself to be drawn into the Ukrainian conflict. Thus, the struggle for world hegemon was limited to the USA versus China.

A key problem for the US is its inability to support the growth of domestic industry. Therefore, the main task of the USA is to dominate the markets in Southeast Asia. As part of this effort, the US has expanded its presence in the Philippines, entered into a military agreement with Indonesia, and is now blocking China's access to the Indian Ocean through Myanmar, where war has just broken out. (Interfax.ru, 2023) The US actively tries to dominate the economic spheres in Southeast Asia. At the same time, China faces problems in its business sector, especially due to the decline in profits from less technological products, which is related to the rising living standards in the country. This leads China to seek new opportunities to sell its high-tech products with higher margins. However, the US makes it difficult for China to enter these areas, which is evident in Europe, where Chinese high-tech products such as laser medical devices are limited due to recently introduced rules and certifications. The US cannot completely exclude the import of less technologically advanced Chinese products, as it does not have sufficient own alternatives and its production would be more expensive, which could have a negative impact on the standard of living of Americans.

At the meeting in San Francisco, in November 2023, US President Joe Biden and Chinese President Xi Jinping focused primarily on the rules of international trade. The Chinese president appealed to Biden not to obstruct the process. He emphasized the need to comply with the trade rules that were set by the United States. Biden, on the other hand, expressed the opinion that China is implementing an inappropriate policy and does not want to back down on key trade issues. It was clear from the positions of both sides that the United States wanted China to adopt the role of a secondary partner that would respect the trade restrictions imposed by the United States and expected the United States to gain more influence in Southeast Asia. These differing expectations have led to a stalemate in negotiations, which is likely to cause further restrictions on Chinese high-tech products in the international market. However, China refused to submit to these conditions. At the end of the meeting, Biden, unlike his Secretary of State Antony Blinken, called Xi Jinping a dictator, indicating considerable strain in relations between the two countries. (Reuters, 2023)

In the coming period, the US will face China as its main geopolitical rival, as well as the countries that provide support to China, including Russia. Russia is set to play an important role in cooperation with Africa and other states, focusing on its naval capabilities, which are crucial given the inferior strength of China's navy compared to America's. However, this does not mean that there will be a direct military conflict between the United States and China. Confrontation can be expected to take place through other states and regions, such as Myanmar (Burma). The result will be an intensification of conflicts of various natures around the world, in which the US will try to consolidate its economic dominance and the monetary hegemony of the USD.

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DETERMINANTS OF REAL ESTATE PRICES IN SLOVAKIA AT THE NATIONAL AND REGIONAL LEVEL

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Abstract: The real estate market in Slovakia has seen significant changes since 2022, caused primarily by the consequences of inflation, which pushed up the growth of interest rates, prices of building materials, and construction works and caused a decrease in the real net income of the population. The aim of the contribution was to identify the influence of economic and sociological variables on the price of real estate at the national and regional level and to point out the differences at the NUTS 3 level. Quarterly data for the period 2006-2022 were monitored, while the multiple linear regression method was used. The results of the study thus confirm the assumption about the different effect of determinants on the price of real estate at the regional level, which gives specific regions room to adapt their own measures in this area.

Keywords: real estate market, real estate prices, interest rate, mortgages, linear regression.

1 Introduction

Real estate prices in Slovakia have undergone turbulent development over the past decades. The relative boom of the Slovak real estate market in the second half of the last decade was mainly driven by the favourable development of the Slovak economy, which represented the basis for positive expectations of the population and a growing willingness to purchase housing. An important role was also played by relatively easily available credit sources intended for housing, which, together with other factors, led to a sharp increase in real estate prices and the emergence of a real estate bubble (Sinicakova et al. 2017). The situation changed in 2008 due to the financial and economic depression, when the real estate market gradually stagnated and real estate prices fell due to external and internal influences. Brzezicka et al. (2019) and Strobel et al. (2018) confirm that the development of the real estate market is closely linked to the development of the business cycle and confirmed by the existence of economic crises. The start-up of the economy after the end of the financial crisis resulted in the stabilization of prices on the Slovak real estate market. The long period of low interest rates resulted in growth in demand for real estate, accompanied by growth in development activity on the supply side (Soltes & Gavurova, 2014, 2015). This has caused property prices to approach their pre-financial crisis highs. However, the pre-crisis boom was much more dynamic, while the pre-coronavirus price growth was caused by price cumulation over a longer period. Before the corona crisis, indicators did not indicate the presence of a real estate bubble in Slovakia, but regional differences were significant and, in some regions, real estate prices were overvalued (Cesnak & Klacso, 2021; Gavurova et al. 2016). As a result of significant shocks such as the coronavirus, inflation growth, the war in Ukraine and price growth energy, there were significant changes in the real estate market after 2020. It faced challenges such as a lack of workers, an increase in the prices of materials and labour costs, as well as anti-inflationary monetary policy measures in the form of an increase in interest rates on the mortgage loan market (Gavurova et al., 2022). These factors also had an impact on changes in the development of real estate prices in Slovakia. Siemińska (2021) confirmed that the period of the Covid 19 pandemic also had an impact on the change of preferences on the real estate market, where, for example, in Poland there was a significantly higher

demand for apartments and houses with their own gardens and for recreational properties.

Existing studies describe a range of economic and social determinants of property prices (Cunha & Lobão 2021; Votava et al. 2021; Zakaria & Fatine, 2021; Pažický, 2020; Belke & Klein 2018; Glaeser et al., 2017; Kokot, 2018, 2020 and others) while these are determinants on the supply and demand side. Chau et al (2001) and Xiao et al. (2019) define tree groups from determinants: permanent (territory, type of building, ecology of the territory, availability of developed infrastructure), conditionally permanent (total area, floor level, construction material, layout, presence of balconies (loggias), availability of an elevator) and conditional variables (engineering communications).

Significant changes in the impact of selected determinants depending on the region of the country were also demonstrated in studies such as Wu and Lux (2018), Dluhoš, (2017), Golej et al. (2016), Zimmer (2015) and others. It can therefore be assumed that the development of real estate prices on the Slovak real estate market will be the result of determinants that act both nationwide and regionally. We will consider the real estate price determinant as a variable that can cause a price reaction at the national or regional level. Uncovering regional determinants can help to explain price differences by place and region in the past and can also help to define measures that can effectively influence the price trend.

The aim of the presented study is to identify the determinants of real estate prices on the Slovak real estate market at the national level and at the same time to identify these determinants at the regional level, which should contribute to explaining the different development of real estate prices at the SK-NUTS 3 level.

1.1 Literature review

The real estate market can be divided into the commercial real estate market, the development of which is primarily influenced by the economic cycle (Kalabiska & Hlaváček, 2022; Pagliari, 2017), and the residential real estate market (Bianchi et al., 2018). Studies by Schindler et al. (2009) and Sunjo and Yilmaz (2017) show that due to the specific position of this commodity, this market cannot be considered efficient. The reason is the impossibility of applying price arbitrage in case of price differences, inelastic supply in the short term and the existence of price bubbles (Schindler et al., 2009; Lyons, 2015; Sunjo & Yilmaz, 2017; Votava et al., 2021.)

The price of real estate is formed by supply and demand on the real estate market, which affect several factors. According to Car (2009), the prices of residential real estate in Slovakia the following factors are the most determined by GDP (economic factor), average number of populations aged from 25 to 44 years (demographic factor), the total volume of household loans (credit-financial factors), the volume of household loans for housing purchase (credit-financial factors), the volume of construction production of residential buildings (economic-technological factor). The intensity of the dependence on the above factors and residential real estate prices is very high. Identifying determinants is an important step towards completion of regression analysis, model construction and subsequent prognosis of the future, he says.

According to analysis Golej et al. (2016), based on the results of correlation and regression analysis, they mentioned as a key determinant of development of Slovak real estate prices as population aged from 25 to 44 years, GDP and interest rates on loans granted to households. According to their study, the state of real estate prices is mainly influenced by regional differences. High real estate prices in Bratislava encourage entrepreneurs to invest heavily in building new real estate and infrastructure.

Dluhoš (2017) analysed a database of 959 building plots in Slovakia using an econometric model based on the OLS, the goal of this paper is to quantify the relationship between selected characteristics and average real estate prices in municipalities in Slovakia. The results indicate that real estate prices in the Bratislava region are statistically significantly higher than in other regions of Slovakia, there is a statistically significant negative relationship between distance from the municipality and the nearest big regional city and the average real estate price of the municipality, and there is a statistically significant negative relationship between the average real estate price of a municipality and the rate of unemployment in this municipality.

Horváthová (2020) investigated the Slovak mortgage sector using methods such as VAR, DEA, panel, and linear regression. The study confirmed that the availability of real estate loans in Slovakia had a significant impact on the growth of real estate prices. From a national point of view, real estate prices in Bratislava have different development factors than real estate prices. Low interest rates play an important role in housing finance.

Poliaková and Kameniková (2023) analysed the Slovak and Czech housing market in 2020-2022. For the evaluation, they used many indicators for comparisons such as housing price indices, average wages, indebtedness, unemployment, and interest rates of the central banks of both countries and hypo index indicators DTI, DSTI, and LTV. The authors find a similar development of the indicators in both countries, the differences were found in the amount of interest rates, due to the different policies of the central banks.

Table 1 presents an overview of world studies focused on real estate market determinants.

Table 1 Overview of determinants used in world studies

Authors	Country	Used models	Determinants
Cunha, Lobão (2021)	EU, Portugal, 25 MSA Portugal	panel regression, regression model, method of least squares	house price index, GDP, average interest rate, construction costs, tourism, house price index for the previous period
Votava et al. (2021)	Czech regions	multiple panel regression, OLS	disposable income, number of inhabitants in an apartment, change of inhabitants, status of inhabitants, marriages, divorces, number of job applicants, number of crimes per 1000 inhabitants
Zakaria, Fatine (2021)	Morocco	Hedonic regression, autocorrelation tests, Geary's test, log-log model	area (m ²), number of floors, property type, address, number of bedrooms, garage, additional services
Pažický (2020)	Slovakia	Method of principal components, Cointegration model, Three-stage panel model	Expectations in the construction industry (ESI)? Interest rates on new loans granted to households, net monetary income, number of inhabitants, unemployment rate, supply of new apartments, interest rates on new loans granted to companies, costs in the construction industry
Belke, Keil (2018)	Germany	panel regression, pooled least squares (POLS) regression, fixed effects model	house prices, apartment prices, rents, transactions, construction, stock of existing apartments, age structure, number of households, unemployment rate, economic structure, average annual disposable income, purchasing power index, number of hospitals, interest
Wang et al. (2017)	China	OLS, regression analysis, spatial lag model, Moran index, geographic detector technique	share of tenants, living space per inhabitant, share of urban population, average wage in cities, price of land, share of population working in the real estate industry, share of employment in the tertiary sector
Grum, Govekar (2016)	Slovenia, Greece, France, Poland, Norway	multiple linear regression	price m ² of residential real estate, unemployment, stock index, current account of the country, industrial production, gross domestic product
Hlaváček et al. (2016)	Slovakia, Poland, Czech Republic, Hungary, Romania	error-correction model	office real estate stock GDP, loans/GDP, HCPI
Panagiotid, Printzis (2016)	Greece	vector error correction model (VECM), cointegration tests, Granger causality	HPI, CPI, IP, retail trade volume, interest rate, annual mortgage growth rate, M ₁ money supply growth rate, unemployment rate

Source: Own processing by the authors.

Cunha and Lobão (2021) highlighted the fact that tourism is one of the determinant factors of real estate prices in Portugal. This is because tourists can rent cottages, villas, and houses (Patwal et

al., 2023) that accommodation enterprises provide for them (Čelik and Čevirgen, 2021). These enterprises also create value addition for economies (Ključnikov et al., 2022a), and provide many job opportunities for unemployed people (Ključnikov et al., 2022b; Civelek and Krajčík, 2022; Civelek et al., 2023), thus, many migrant employees work for tourism and hospitality sectors (Přivarová et al., 2022). For this reason, the increase that these sectors cause in the demand of real estate also increases prices. This fact can also be a good example to explain how tourism sector can make changes in economy of a country (Shpak et al., 2022).

The different dynamics of price development from the point of view of location are documented by Glaeser et al. (2012) when they compare poorer areas versus richer ones using the example of large American cities. In this case, the level of employment in individual locations also plays a role. Zimmer (2015) subsequently confirms the importance of location for price formation in the USA and compares this result with the unproven dependence of prices between individual OECD countries. On the other hand, the analysis of individual regions of the German market shows a strong connection of real estate prices to demographic data, infrastructure, and basic economic variables (Belke & Keil, 2018). Wu and Lux (2018) analysed U.K. regional real estate prices from 2005 to 2017 to identify factors influencing house prices (regional versus national) and potential price bubbles. They used the Gordon dividend discount model, and they considered house prices as the present value of imputed rents. They differentiated between long-term and short-term effects using pooled mean group (PMG) and mean group estimation (MG) to determine variations in regional house prices. Regional trend analysis shows that house price growth in the regions has been affected differently in the short run and each region has varying long-run fundamentals. Other studies (Androniceanu, 2023; Androniceanu et al., 2022a; Androniceanu et al., 2022b) analysed the relationships between economic growth, digitalization, and political stability which influenced the real estate market in different European states.

Votava et al. (2021) confirmed that there are determinants that are linked to the Czech real estate market at the regional level. For five of the eight determinants such as net disposable income, number of inhabitants, number of inhabitants per completed apartment, average population status, number of applicants for one job and number of divorces, it was proven based on regional data that these determinants act differently in selected regions and have thus the importance for explaining the different prices of apartments in the Czech Republic.

Based on the results of studies such as Glaeser et al. (2012), Zimmer (2015), Golej et al. (2016), Dluhoš, (2017), Belke and Keil (2018), Wu and Lux (2018), Votava et al. (2021) or Cunha Lobão (2021) we can assume that at the regional level the selected determinants have a different impact on the real estate price.

2 Data and Methodology

The presented study is based on the analysis of data for the period 2006-2022 at the quarterly level. Data sources are publicly available databases such as National Bank of Slovakia (NBS), Statistical office of Slovak Republic (SOSR) and Eurostat. For the purposes of the study, variables are monitored at the level of Slovakia as well as at the regional level, while the legislative division into eight regions (Bratislava Region (SK-BL), Trnava Region (SK-TA), Nitra Region (SK-NI), Trenčín Region (SK-TC), Zilina Region (ZA), Banská Bystrica Region (SK-BC), Prešov Region (SK-PV) and Košice Region (SK-KI)). Region abbreviations correspond to ISO 3166-2 codes for Slovakia. The influence of twelve selected determinants on the price of real estate in selected regions is investigated using linear regression models.

The models include as explained variables real estate prices (P) for Slovakia as a whole and for individual regions, which represent the average nominal offer prices of real estate in

Euro/m² published quarterly by the NBS adjusted for inflation using the consumer price deflator from Eurostat. When determining the prices of residential real estate, the NBS bases it on the database of the National Association of Real Estate Agencies of Slovakia (NARKS), which contains data obtained from entities involved in the mediation of the purchase and sale of real estate. A description of the construction of the indicator, which represents real estate prices, is available in the methodological instructions on the NBS website. Table 2 lists selected explanatory variables and their predicted impact on real estate prices according to available studies.

Table 2 Overview of monitored determinants in the presented study and their impact in the case of available studies

Determinant	In short	Database	A scientific study in which the relationship to the price of real estate was analysed	The influence of determinants on real estate prices according to the selected study
Marriages (number of marriages per thousand inhabitants)	M	SOSR	Votava et al. (2021)	statistically insignificant
Divorces (number of divorces per thousand inhabitants)	D	SOSR	Hlaváček, Komárek (2011)	positive
GDP per capita (€)	GDP	SOSR	Cunha, Lobão, (2021) Grum, Govekar (2016) Hlaváček et al. (2016) Égert, Mihaljek (2007)	statistically insignificant statistically insignificant positive positive
Unemployment rate (%)	UN	SOSR	Belke, Keil (2018) Panagiotidi, Printzis (2016) Grum, Govekar (2016) Égert, Mihaljek (2007)	negative negative negative negative
Net cash income of households (€)	NIH	SOSR	Votava et al. (2021) Belke, Keil (2018) Wang et al. (2017) Algieri (2013) Égert, Mihaljek (2007) IFP (2020)	statistically insignificant positive positive positive positive positive
Interest rates on housing loans granted to households (%)	IRH	NBS	Cunha, Lobão (2021) Algieri (2013) Égert, Mihaljek, (2007) IFP (2020)	negative negative negative negative
Price index of construction works (2015=100)	PIW	SOSR	Cunha, Lobão (2021) Pažický (2020)	statistically insignificant positive
Price index of building materials (2015=100)	PIM	SOSR	Cunha, Lobão (2021) Pažický (2020)	statistically insignificant positive
Population growth (the difference between the number of live births and the number of deaths)	PG	SOSR	Votava et al. (2021) Algieri (2013)	both positive and negative in different regions positive
Total value of housing loans (million €)	TVHL	NBS	Panagiotidi, Printzis (2016)	positive

Source: Own elaboration.

The present study works with two basic forms of multiple linear regression models, namely a national-level model expressed by relation 1 and eight regional-level models expressed by relation 2.

$$P_SK_t = \beta_0 + \beta_1 M_t + \beta_2 D_t + \beta_3 GDP_t + \beta_4 UN_t + \beta_5 NIH_t + \beta_6 IRH_t + \beta_7 PIW_t + \beta_8 PIM_t + \beta_9 PG_t + \beta_{10} TVHL_t + u_t \quad (1)$$

$$P_NUTS3_{it} = \beta_0 + \beta_1 M_{it} + \beta_2 D_{it} + \beta_3 UN_{it} + \beta_4 NIH_{it} + \beta_5 PG_{it} + \beta_6 IRH_{it} + \beta_7 PIM_{it} + \beta_8 TVHL_{it} + u_{it} \quad (2)$$

Where t represents the time period (time series from Q1 2006-Q4 2021 are available for all variables) and i represents one of the eight regions according to the SK-NUTS 3 classification with designation based on ISO 3166-2 for Slovakia. The only

variable that does not change in the models at the regional level is the IRH, which are determined and reported centrally for the entire territory of Slovakia. Including this significant variable in the model at the regional level made it impossible to build a fixed effects model that works with panel data. For this reason, multiple linear regression models were preferred, which allowed the interpretation of the models for each region individually.

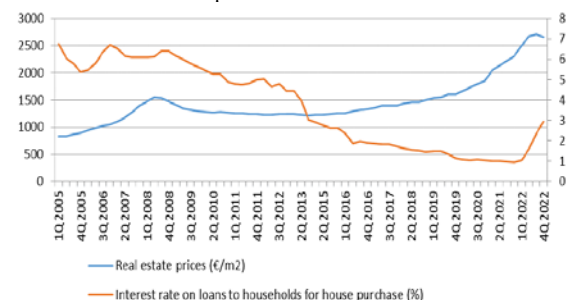
Constructed models for Slovakia and individual regions have a different number of variables, which was determined by the availability of data for the given indicator. At the level of Slovakia, there are ten variables, at the level of the regions eight variables were available. At the regional level, quarterly data were not available for the variables GDP per capita (GDP) and the construction price index (PIW). Data at the regional level are seasonally adjusted using the method of equalization using seasonal indices. Both types of models are tested for the presence of heteroscedasticity (Breusch-Pagan test), order dependence (Breuch-Godfrey test), cross-sectional dependence (Pesaran CD test), multicollinearity (correlation coefficient) and stationarity (Maddala-Wu test). In case of violation of the assumptions of the model, the data are modified in the form of first differences (solving the problem of multicollinearity). The presence of autocorrelation and heteroskedasticity is solved by estimating the standard errors of the regression coefficients using the HAC matrix.

3 Results and discussion

3.1 Determinants of real estate prices at the level of Slovakia

Strong economic factors generally create conditions for a strong growth in real estate prices. Record-low unemployment combined with dynamic wage growth, low interest rates and a longer-lasting economic conjuncture increase asset prices. In the development of the Slovak real estate market since 2005, it is possible to find two significant turning points in time. The first occurred around 2008 when, as mentioned, after a long positive development of the economy, there was an increase in real estate prices. The rate of growth of real estate prices exceeded the rate of growth of other economic fundamentals, which led to a real estate bubble, which was also confirmed by Pažický (2020) based on his analysis in Slovakia. During this period, the increase in real estate prices was also accompanied by a decrease in interest rates on the mortgage market. After the global financial crisis, there were steps in the area of monetary policy that led to extremely low mortgage loan prices and further supported the growth of real estate prices, which can also be seen in Figure 1. The growth of real estate prices in the pre-pandemic period represented a gradual cumulative growth, and thus it no longer showed the characteristics of a real estate bubble as it did in 2008. At the beginning of 2022, there was an increase in interest rates under the influence of high inflation, which could be the most significant determinant of stagnation and a humiliating decline in real estate prices at the end of 2022. Based on Figure 1, it is possible to assume a negative impact of interest rates on the price of real estate in Slovakia, which is in line with studies published so far such as Égert, Mihaljek, (2007), Algieri (2013), Pažický (2020), Cunha, Lobão (2021) and others.

Figure 1 Development of real estate prices and interest rates for household loans for the purchase of real estate



Source: Own processing according to NBS.

For a more in-depth analysis of the determinants of real estate prices in Slovakia, a linear regression model was built, where the explanatory variable is the real estate price in €/m², and the set of explanatory variables consists of ten economic and social determinants for the period Q1 2006-Q4 2021. Testing the assumptions of the original form of the model, which represents the relationship 1 demonstrated problems of heteroskedasticity, autocorrelation and multicollinearity. Table 3 presents the test results of the original model.

Table 3 Results of model testing at the level of Slovakia (quarterly periodicity)

Subject of testing	Method	Value test. statistics
Normality of residuals	Shapiro-Wilk test	0,2279
Heteroskedasticity	Breusch-Pagan test	0,0002
Autocorrelation	Breuch-Godfrey test	<0,001
Multicollinearity	The variance inflation factor	>10
	Farrar-Glauber test	<0,001

Source: Own processing of the output from the RStudio program.

The problem of multicollinearity was solved by first differences, but autocorrelation and heteroskedasticity remained present in the model. Subsequently, the estimation of standard errors of regression coefficients using HAC matrices was chosen.

Table 4 Summary of the transformed model at the level of Slovakia (quarterly periodicity)

Determinant	Regression coefficients	Standard error	t value	Pr(> t)	Signs of statistical significance
β_0	-0,2050	0,0351	-5,8345	0,0000	***
M	-0,0968	0,0828	-1,1694	0,2479	
D	-0,0547	0,0657	-0,8338	0,4084	
UN	0,1532	0,0774	1,9810	0,0532	.
NIH	2,1417	0,7008	3,0563	0,0036	**
IRH	-0,4002	0,0912	-4,3877	0,0001	***
PIW	-0,9548	0,9589	-0,9957	0,3243	
PIM	1,2769	0,2908	4,3910	0,0001	***
PG	-0,000001	0,0014	-0,0009	0,9993	
TVHL	0,7337	0,1730	4,2406	0,0001	***
GDP	0,5012	0,4254	1,1782	0,2444	
R ²	0,8057				
Modified by R ²	0,7661				
p value	<0,001				

Source: Own processing of the output from the RStudio program.

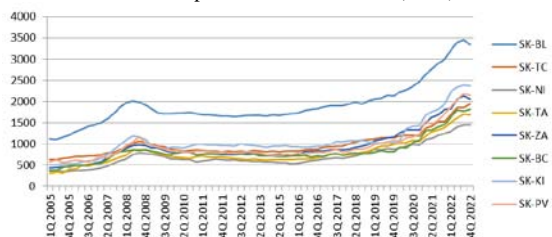
Based on the estimation of regression coefficients using the HAC matrices in Table 4, which take into account the present problem of autocorrelation and heteroskedasticity, a statistically significant positive dependence between real estate prices and the determinants of the average nominal monthly wage, the price index of construction materials and provided housing loans was demonstrated at the 0.05 level. A significant negative dependence was demonstrated with the interest rate determinant.

3.2 Real estate price determinants at SK-NUTS level 3

Available studies have shown that there are regional differences in the development of real estate prices, which may be caused by different determinants. In Slovakia, there are significant differences in real estate prices (see Figure 2), which can also be

caused by the development of economic foundations at the regional level.

Figure 2 Development of real estate prices in the regions of the Slovak Republic from 2005-2021 (€/m²)



Source: Own processing according to NBS.

Figure 2 illustrates significantly higher real estate prices in SK-BL, which can be linked precisely to significantly higher economic indicators such as GDP per capita and higher net cash income of households compared to other regions of Slovakia. The development of real estate prices in 2022 points to a change in the development of real estate prices downwards, which was most pronounced in the given period in SK-BL, SK-ZA and SK-TA, which represent the regions in the west of Slovakia near the capital.

In the models at the level of regions, the represented figure of GDP per capita is missing, but also based on the study of Votava et al. (2021), it is possible to assume a high degree of correlation between GDP per capita and net income of households at the level of regions. At the regional level, only annual GDP per capita data were available, while the average correlation between annual GDP per capita data and household net cash income was 0.89. This implies the assumed equal influence of both variables on the price of real estate at the NUTS 3 level in the case of quarterly data. In terms of GDP per capita and real estate prices on an annual basis, the value of both variables was significantly higher in the case of the Bratislava region (SK-BL).

A separate multiple linear regression model was created for each region of Slovakia according to relation 2. The stationarity of the time series was ensured and the problem of multicollinearity was eliminated with the help of first differences. In the case of the presence of heteroskedasticity and autocorrelation, estimation of standard errors of regression coefficients using HAC matrices was used. Table 5 shows the results of the transformed models at the level of regions.

Table 5 Estimate and significance of regression coefficients in Slovak regions based on the model

NUTS 3	Determinants										R ²
	M	D	UN	NIH	PG	IRH	TVHL	PIM			
SK-BL	-0,0246 p=0,7111	-0,0282 p=0,6165	0,0454 p=0,2051	1,0743*** p=0,0091	0,0028 p=0,3779	-0,2802 * p=0,0115	0,5490** p=0,0031	1,2402 *** p<0,001			65,66
SK-TV	-0,0296 p=0,2921	0,0680 p=0,2137	0,0320 p=0,1928	0,6665 * p=0,0336	0,0003 p=0,9055	-0,1717 . p=0,0824	0,5379 * p=0,0119	1,3828 *** p<0,001			71,24
SK-NI	-0,2253 * p=0,0394	0,2099 * p=0,0410	0,0430 p=0,0231	1,8368 *** p<0,001	-0,0017 p=0,4550	-0,0963 p=0,5636	1,1729 *** p<0,001	1,4055 ** p=0,0025			74,67
SK-TA	-0,0863 p=0,2618	0,0187 p=0,8093	0,0842 p=0,2347	2,5188 *** p<0,001	-	-0,3233 . p=0,0736	1,1932 *** p<0,001	1,207 ** p=0,00267			73,37
SK-ZA	-0,0758 p=0,3580	0,0491 p=0,5189	0,0788 p=0,2818	1,1763 . p=0,0964	-0,0091 p=0,0779	-0,3907 . p=0,0507	1,3292 *** p=0,0024	1,7314 *** p=0,0003			69,02
SK-BC	-0,0479 p=0,6386	0,1661 * p=0,0581	-0,4662 *** p<0,001	2,6313 *** p<0,001	0,0012 p=0,2190	-0,4239 ** p=0,0058	1,1755 *** p<0,001	1,7630 *** p<0,001			76,1
SK-PV	-0,1471 p=0,1346	-0,0161 p=0,9014	0,0455 p=0,7053	2,6609*** p<0,001	-0,0643 p=0,3449	-0,1228 p=0,5095	0,7074 ** p=0,0092	1,7443 *** p<0,001			69,56
SK-KI	-0,2248 . p=0,0840	0,2907 * p=0,0442	0,2886 p=0,3051	0,5550 ** p=0,03168	-0,0261 ** p=0,0045	-0,5526 . p=0,0619	2,0466 *** p<0,001	2,0074 *** p<0,001			65,45

Source: Own processing of the output from the RStudio program.

The results in Table 5 show a positive relationship between real estate prices and housing loans in all regions, while the same result is also observed for the variable price index of construction materials. The regression coefficients of the

determinant of net cash income of households reach positive values in all regions of Slovakia. These findings show that there are economic variables on the demand and supply side of real estate that have the same effect on real estate prices regardless of region. In most cases, the monitored determinants have a non-uniform influence on the explained variable. For example, the relationship between interest rates and real estate prices in most regions is negative, while in SK-NI and SK-PV it is statistically insignificant. The relationship between real estate prices and the unemployment rate can be considered statistically insignificant, with the exception of SK-BC, where the model demonstrates a positive relationship. In the case of determinants of a social nature, there are statistically significant links between real estate prices and variables to a lesser extent than in the case of economic determinants, while their links differ in individual regions not only in strength, but also in the direction of dependence. Statistically significant links of real estate prices with marriages and population growth are negative, while the determinant of divorces is a positive link. The importance of social variables was demonstrated only in three regions, at the level of SK-NI, SK-BC and SK-KI. The models compiled at the regional level have shown that there are determinants that have a different impact on the price of real estate in the region and have the potential to explain the different development of prices in the regions of Slovakia.

3.3 Evaluation of results in the context of existing studies

Constructed models for Slovakia and individual regions showed a different type of selected variables at the national and regional level. Table 6 presents a comparison of the results of the present study and the available studies.

Table 6 Comparison of the results of constructed models and existing studies

Determinant	Influence at the SR level	Influence at the level of regions	The influence of determinants on real estate prices according to the selected study
Marriages (M)	statistically insignificant	negative (SK-NI, SK-KI) statistically insignificant in other regions	statistically insignificant (Votava et al., 2021)
Divorces (D)	statistically insignificant	positive (SK-NI, SK-KI), statistically insignificant in other regions	positive (Hlaváček, Komárek, 2011)
GDP per capita (GDP)	statistically insignificant	-	statistically insignificant (Cunha, Lobão, 2021, Grum, Govekar, 2016) positive (Hlaváček et al., 2016, Égert, Mihaljek, 2007)
Unemployment rate (UN)	statistically insignificant	negative (SK-BC), statistically insignificant in other regions	negative (Belke, Keil, 2018, Panagiotidi, Printzis, 2016, Grum, Govekar, 2016, Égert, Mihaljek, 2007)
Net cash income of households (NIH)	positive	positive in all regions	statistically insignificant (Votava et al., 2021) positive (Belke, Keil, 2018, Wang et al., 2017, Algieri, 2013) Égert, Mihaljek, 2007, IFP, 2020)
Interest rates on housing loans granted to households (IRH)	negative	statistically insignificant in SK-NI and SK-PV, negative in other regions	negative (Cunha, Lobão, 2021, Algieri, 2013, Égert, Mihaljek, 2007, IFP, 2020)
Price index of construction works (PIW)	statistically insignificant	-	statistically insignificant (Cunha, Lobão, 2021) positive (IFP, 2020)
Price index of building materials (PIM)	positive	positive in all regions	statistically insignificant (Cunha, Lobão, 2021) positive (IFP, 2020)
Population growth (PG)	statistically insignificant	negative in SK-KI, statistically insignificant in other regions	both positive and negative in different regions (Votava et al., 2021) positive (Algieri 2013)
Total value of housing loans (TVHL)	positive	positive in all regions	positive (Panagiotidi, Printzis, 2016)

Source: Own elaboration.

Analysis of data from 2006-2021 showed a significant influence of selected determinants of supply and demand. On the demand side, real estate prices were raised by increasing net household incomes, which was demonstrated by the example of all monitored regions, despite the high differences in the amount of net income between CK-BL and other regions. Due to the high rate of inflation in 2022 and 2023, there is a reduction in net cash income, which should lead to stagnation or a decrease in real estate prices in each region. Another important factor that could confirm this downward direction of real estate prices is the impact of interest rates on mortgage loans for households, which have risen significantly in the recent period. The results of the models confirm that the growth of interest rates for households has a negative impact on the price development at the regional level as well. The total value of housing loans at the national and regional level had a positive effect, which was in line with the result of the study Panagiotidi and Printzis (2016). Only in two regions such as SK-NI and SK-PV was this effect statistically insignificant. An important factor on the supply side was the rise in the prices of construction works and materials. At the national and regional level, the positive impact of the growth of these indicators on the price of real estate was demonstrated, despite the fact that the pace of their growth differed between regions.

In the case of basic economic fundamentals such as GDP per capita and the unemployment rate, the statistical impact of these variables has not been proven at the national level. The statistically insignificant effect of GDP on the price of real estate confirmed the results of the study by Cunha and Lobão (2021). In the case of the unemployment rate, it was expected that its decrease would increase the demand for real estate, which would affect the growth of their price. However, this indicator also proved to be statistically insignificant, with the exception of SK-BC.

Population growth was among the group of indicators for which a positive impact was assumed at least at the national level. However, the compiled models showed statistical insignificance for most regions except SK-KI.

The presented study identified the impact of selected sociological variables such as marriages and divorces, which were followed in their study by Votava et al. (2021). The authors found a statistically significant effect only for divorces. The results of the models for the regions of Slovakia showed a consistent effect only in the case of the SK-NI and SK-KI regions, with a negative effect on marriages and a positive effect on divorces. At the national level, the effect was statistically insignificant, which is consistent with the studies analysed.

4 Conclusion

The real estate market has undergone significant changes over the past twenty years, and nowadays it can also be considered a political issue. Since the real estate bubble in 2008, there has been a phase of stabilization in the real estate market, but low interest rates on housing loans as well as the growth of net household income led to renewed pressure on price growth, which was also confirmed by the results of the presented study. Pažický (2020) pointed out that the growth of real estate prices after 2015 did not show signs of a new real estate bubble. At the regional level, there was gradual overheating during this period in the Nitra, Zilina and Trencin Regions, but still not at the level of 2008. In the case of the Bratislava Region, real estate prices moved in line with the development of economic fundamentals. The combination of low interest rates and high net income led many citizens to increase demand for "investment" properties, which again pushed prices up. The relationship between the price of old properties and new buildings, which were at a similar level, was also unnatural. At the same time, there was increasing pressure on the growth of the number of new buildings from the position of the government, which was taking steps towards a significant increase in the number of rental apartments, thereby wanting to increase the availability of housing for the inhabitants of Slovakia. One of the steps was the

submission of changes in the Construction Act, which would make it possible to shorten the length of the construction procedure. This usually takes 300 days in Slovakia and according to Doing Business, is one of the longest in the world. It is the lack of construction that represents another factor in the growth of real estate prices in Slovakia (Halenár, 2021). Under the influence of the current rise in interest rates and the decrease in net income due to high inflation, the availability of housing has become a key issue for many people. Even the growth of wages in the private sector was not sufficient compensation for the changes in the mortgage market. Employees of the public sector, whose salaries have not been valued as much as in the private sector, fall into a vulnerable group in terms of the availability of mortgages. In the case of already existing mortgages, the increase in instalments can also negatively affect the ability of households to repay these obligations. The growth of real estate prices can also lead to problems with interregional migration for work, which reduces the flexibility of the labour market (Sunega et al., 2010; Kubala & Peciar, 2019). However, the present study does not include this view.

The presented study confirmed that there are differences between regions in the determinants that affect real estate prices. These are divorces, marriages, population growth or the unemployment rate. For this reason, it would be appropriate to give municipalities more room to influence the real estate market, for example by adjusting real estate tax rates. These can be increased by local governments in the case of unoccupied real estate or adjusted in the case of residents with permanent residence in the given real estate. The solution is also the regulation of construction by the municipality in case of overheating of the market. The overvaluation of prices in the regions can be mitigated by local governments with appropriate measures to make spatial plans more flexible, speed up the issuance of territorial decisions and building permits.

The presented study also has its limits, which can be seen at the level of the monitored data. The first limitation is the use of a short time period of 2006-2022, which was extended by using quarterly data. However, this caused some variables to drop out, which could not be included in the models. It was primarily data at the regional level, such as quarterly GDP or the quarterly occurrence of crimes, which could represent another sociological indicator. In the future, it would be appropriate to add the number of newly built apartments and the number of applicants for one job to the set of variables. Likewise, psychological-expectational determinants were not the subject of this study. Expectations of future property price developments may influence speculative purchases in the future. This dimension could be supplemented with the help of another monitored indicator such as the Economic sentiment indicator (ESI) and its component focused on expectations in the construction industry. Another dimension that the study does not examine is the influence of determinants on different categories of real estate when divided according to the size and purpose of use of the real estate. It is also possible to assume that differences also enter when monitoring the influence of determinants at the level of regional places and other parts of the region. Especially in the case of social variables, it is possible to assume different intensity of influence on the price of real estate in a given location. In the case of this topic, there is a lot of room for further research, especially at the regional and local level.

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Primary Paper Section: A

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MULTIGENERATION WORK ENVIRONMENT IN THE DIGITAL ERA - EXPECTATIONS OF GENERATION Z, CHALLENGES OF EMPLOYERS AND MANAGEMENT

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The paper is published within the frame of grant - VEGA 1/0441/21 Analysis of the work expectations of Generation Z and the assumptions of its future application on the labor market.

Abstract: After Generations X and Y, Generation Z also enters the world of work. Since the entry of representatives of Generation Z into the labor market has various consequences, it is important to know the values and opinions of this new generation, only then can it be possible to anticipate and implement changes, whether in the conditions their hiring, working conditions and working environment, in the care of employees, or in the nature of the employee benefits provided. Regarding the expectations of employees of Generation Z, we conducted two separate investigations, the results of which we present in this scientific study. Employers' and management's approach to this generation is changing, employers themselves must face new challenges and adapt in order to remain competitive.

Keywords: multigeneration, Generation Z, digital natives, Generation Y/Millennials, work environment, expectations, challenges

1 Introduction

Society is made up of multiple generations and while some differences are age-related, others are influenced by upbringing, culture, values and experiences. We can generalize that each generation has its own characteristics and influence on the society it forms. Differences between generations in values, demands, expectations, preferences, thinking, behavior and communication styles can cause conflict situations, but can also contribute to diversity and innovation. We believe that it is important to know and understand the different generations in order to better communicate and work together to create a better future for all. Of course, the work area is also connected with this, since in the workplace today we meet employees of several generations, who must be able to adapt and cooperate. Managers have to deal with a work environment that is both multicultural (see more in Milošovičová, 2018) and multigenerational.

In connection with the generational issue, already at the beginning of the 20th century, experts began to study the differences between generations and to deal with how representatives of individual generations differ in their attitudes and behavior. Generations are often judged by their span, and while there is no strictly agreed-upon formula for how long that span should be, a span of 15-20 years is established. According to McCrindle and Wolfinger, today's generations are defined sociologically rather than biologically, and the term generation today refers to a group of people born in a similar time span, who share a comparable age and life stage, and who have been shaped by a certain period of time - events, trends and developments. (McCrindle and Wolfinger, 2014) The environment in which each generation grows up, the events that occur at that time, economic and social changes, technological development - all this shapes the opinions of the representatives of the given generation - the generational cohort.

2 Multigenerational workforce

The labor market consists of individuals of different generations. Older or younger employees, each of them has something to contribute. Individuals have different experiences, they contribute their own skills and knowledge to the work team. According to the AARP survey on multigenerational work and mentorship the employees value the unique perspectives that a multigenerational workforce brings to their workplace. „In particular, workers value the give and take aspect in a multigenerational work environment. For older workers, their

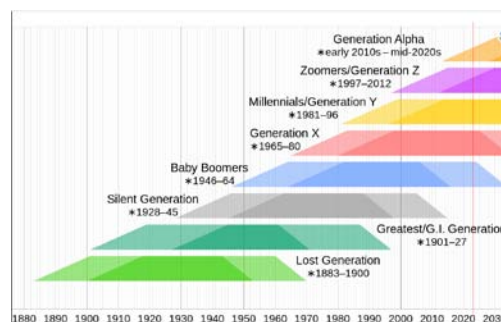
younger colleagues offer an opportunity to pass on their skills and knowledge (79%) and are valued for the creativity they bring to the work environment (73%). For younger workers, older colleagues are valued for their skill as teachers (77%), for providing an opportunity to consider a different perspective (76%), and for making the workplace more productive (69%).” (Anderson - AARP Research, 2019) Currently, 4 generations coexist in the workplace, which is why leading a multigenerational team is not easy and faces challenges.

2.1 The generation defined and timeline of generations

Based on the study of various literary sources, which were devoted to generations, we can conclude that we distinguish several generations, and currently the most often mentioned are those that are represented in society and also on the labor market. They are the Baby Boomers ("B" - born between 1946 and 1964), then Generation X ("X" - born between 1965 and 1980), then Generation Y ("Y" - born between 1981 and 1996) and Generation Z ("Z" - born between 1997 and 2012). Representatives of these generations were or still remain in the labor market (B) or are fully active in the labor market (X and Y) or are entering the labor market (Z). In some sources, the future generation - Generation Alpha (born after 2012), which has not yet entered the labor market, but is currently in the education stage, is already outlined and mentioned. In connection with this generation, we are of the opinion that it is necessary to begin to pay due attention to this generation and begin to examine its needs and address the issue of its education for the needs of the labor market.

The entry of employees of individual generations into the labor market, their influence on the market and the departure of employees from the labor market is demonstrated by the graph below, which we used to illustrate it for its clarity.

Figure 1 : The Generation Defined



Source : Timeline of generations in the Western world as in its Wikipedia article with notable events. By CMG Lee - Own work, CC BY-SA 4.0 <https://commons.wikimedia.org/w/index.php?curid=91612069>

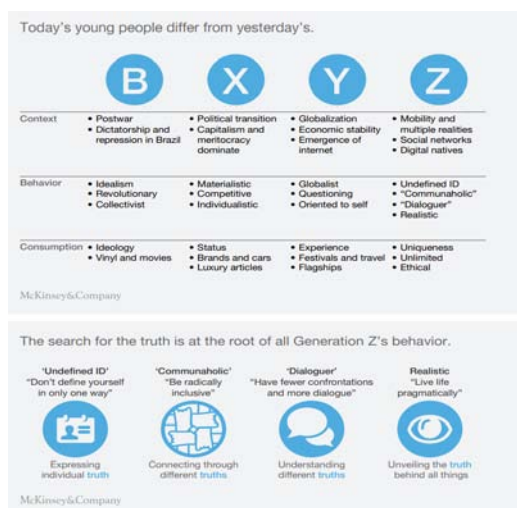
We would like to point out that the Pew Research Center, as a research center, has been measuring public attitudes on key issues for decades and documenting differences in those attitudes across groups. It uses generational cohorts in survey comparisons, which is why the Pew Research Center also decided in 2018 to determine the cutoff point between Millennials and the next generation. Five years ago, they used 1996 as the last year Millennials were born, and they believe this year marks a meaningful boundary between Millennials and Generation Z for a number of reasons, including key political, economic and social factors that define Generation Y's formative years. (Dimock, 2019) Several authors lean towards 1996 as the boundary year dividing Generation Y and Generation Z, although we must mention that there are also sources that perceive 1995 as such a boundary year (e.g. Francis and Hoefel,

2018) or even 2005, respectively 2004 (e.g. Neil, 2014; Generation timeline / After the Millennials generation XYZ consulting).

In connection with the interface between Generation Y and Generation Z, we would also like to point out that we can also sometimes encounter the term "Zillennials" or "Zennials". This term can include those on the cusp of Generation Z and Millennial - people who were born shortly before the turn of the millennium. This group of people includes older Gen Zers, who have been in the workforce for several years and young Millennials, who identify more with Generation Z. (McKinsey & Company, 2023)

Each of the four mentioned generations has its own characteristics that influence the way they perceive and interact with the world. Already in 2018, Francis Tracy and Hoefel Fernanda from McKinsey & Company conducted a survey and when publishing the results in their publication, provided an interesting comparison of the qualities and characteristics of individual generations. Even then, it was obvious that the influence of Generation Z was expanding. Indeed, the survey showed that the behavior of Generation Z is rooted in one element: the search for the truth of this generation. For Gen Zers, the key point is not to define themselves through just one stereotype, but rather for individuals to experiment with different ways of being themselves and shape their individual identities over time. In this regard, we could call them "identity nomads". The representation of the results of the aforementioned survey on the issue of comparing generations is presented in Figure 2.

Figure 2 : The Generation Comparison



Source: Francis T., Hoefel F. 'True Gen': Generation Z and Its Implication for Companies, 2018. [online]. <https://www.mckinsey.com/~media/McKinsey/Industries/Consumer%20Packaged%20Goods/Our%20Insights/True%20Gen%20Generation%20Z%20and%20its%20implications%20for%20companies/Generation-Z-and-its-implication-for-companies.pdf>

Baby Boomers are often described as an idealistic and passionate generation who set out to improve the world. It is a generation of hardworking and disciplined employees. They are professionals who have great know-how and are motivated by financial rewards. Generation X is often characterized as individualistic and skeptical of authority. It is a viable, highly educated generation, „brings a different mindset to the workplace by bringing balance to his teams, prioritizing diversity and work-life balance. This generation likes to work with other colleagues and diversify their routine activities. Thanks to this independent mindset, Generation X finds ways to be efficient in the workplace so that they can also focus on their personal lives or mental rest." (BE-ID human, 2022) Generation Y employees/ Millennials prefer more efficient ways of working, use

innovative ways of fulfilling tasks and goals. Millennials are characterized by their dependence on technology and flexibility at work, while Generation Z is growing up with an even greater dependence on technology and an interest in social issues such as climate change and equality. (Parker, Graf and Igielnik, 2019) While they enjoy working with Millennials, they value independence. Due to the differences of individual generations, the manager has a difficult task in managing a multigenerational team. „Acknowledging age and competences can help managers understand and define each generation's elements of motivation as well.“ (INSPIRER, 2021)

2.2 Generation Z as successor to Generation Y in the time of technological progress

Due to the development of society, the impact of social, economic, political and economic changes, the attitudes, mindset and demands of individuals change. What was essential for the older generation, the younger generation puts in the background and vice versa.

We are of the opinion that technology and its use are one of the fundamental things that significantly differentiate generations X, Y and Z. Even though Generation X encountered computers, only Generation Y mastered working with them and already used them significantly and also began to communicate with the world through the Internet, Generation Z is the generation that grew up in a world of enormous technological progress. Whether an individual did not use technology or, on the contrary, fully used it, influenced his behavior at the time, his outlook and preferences on private and work life, as well as communication with friends and colleagues at work.

The group of individuals born between 1997 and 2012 has different names - "Generation Z", "Generation Zoomers", "iGeneration", "Post-Millennials", during the COVID-19 crisis "Generation C". The term "Homeland Generation" began to be used in the middle of the 21st century by LifeCourse Associates and is connected to the idea that this generation of children was literally more "at home" than any previous generation of children, thanks to the protective and hands-on parenting style of Gen-X parents. (Howe, 2014) Among all names, the term "Generation Z" has become established within the professional public and society.

Social media, constant connectivity, entertainment and on-demand communication are innovations that Generation Y members have adapted to as adults. However, for those of Generation Z, born after 1995, these are largely assumed. (Dimock, 2019) They were exposed to the Internet, social networks and mobile systems from an early age, they grew up on technology. Since Generation Z lives in the digital era, they are used to constant updates, improvements, therefore Generation Z can be called "digital natives". Dingli and Seychell (2015, p. 9) commented: "Digital natives are today's young people who were born into the digital era and are growing up exposed to the continuous flow of digital information. Digital natives are a generation or population growing up in the environment surrounded by digital technologies and for whom computers and the Internet are natural components of their lives. They do not need to familiarise themselves with the technology by comparing it to something else. On the contrary, they propose new ways of thinking about how technology can be effectively used." The experience and knowledge of these young people in the digital age are very valuable for companies.

2.3 The Generation Z entering the labor market

If we assume that an individual starts working properly only after completing university studies (an individual aged 24-25), Representatives of Generation Z born in 1997 entered the labor market literally in the post-pandemic period. These "Post-Millennials are entering adulthood with less experience in the labor market than prior generations." (Fry and Parker, 2018) Some of them also worked in the form of part-time work or shorter hours, this way they gained experience, but after

completing their studies they become a full-fledged full-time workforce, entering their professional life.

What job are they applying for? What is important to them in the work environment? Their view was influenced by the events of the time, which definitely includes the COVID-19 pandemic. The way they communicated, gained new contacts and educated themselves during the pandemic also affected their attitude to work and the idea of how they should perform their work at the employer. Affected by the pandemic, they attach great importance to interpersonal relationships and therefore look for a pleasant working environment. Financial resources are important to them, but "they may not always be the top job priority. Instead, their list includes flexibility to work from the office and remotely, wellness and mental health initiatives as well as meaningful work and culture." (Abril, 2022)

Overall, it can be seen from the preferences of this young workforce that, in addition to wanting to be financially secure and wanting to have some freedom in order to be able to combine work with private affairs, they demand from the employer, as it were, comprehensive care for their body and soul. They expect to be taken as they are. It seems that in the past a job was created and an employee was sought for the given job, the employee had to adapt, today there is a period when the job will seem to adapt to the young employee and his requirements.

In connection with Generation Z (also partly with Generation Y), employers encountered the trend of "quiet quitting. A typical attitude of the employee is that he will only do the work that is necessary to do and that is paid for. It is related to the dissatisfaction of the employees at work, and therefore the employees limit themselves only to the work that is in their job description. "They don't spare an extra minute and don't participate in non-work, volunteer activities organized by the company. They won't even participate in team building or an evening meeting with colleagues and the boss." (Fabrici, 2023) Employers also have to deal with this negative phenomenon, which tends to affect not only company productivity, but also the professional growth of individuals, which was also confirmed by the State of the Global Workplace: 2023 Report (GALLUP, 2023). As stated by Gabrhelová et al, (2019), job satisfaction is an important factor influencing the whole organizational behaviour as a part of sustainable enterprise development.

3 Methodology and methods

Treľová and Hlásny conducted two scientific surveys in 2023. In both researches, we set a relevant empirical goal, and in both conducted researches, we tried to obtain the first data in the new digital era context and in a specific target group of respondents. From a methodological point of view, we will consider both conducted research as preliminary research verifying the validity and reliability of both research tools. The data obtained through the questionnaire were processed using the Kolmogorov-Smirnov test, performed in SPSS at a significance level of 0.5.

4 Results of the research

Primarily, in 2023 Treľová and Hlásny conducted research on aspects that are important for respondents from Generation Z when choosing an employer. They also investigated differences in terms of gender. 507 respondents, whose average age was 22, took part in the research. Of these, 337 (66.4%) respondents were women and 169 (33.6%) respondents were men. The scale of the questionnaire used for individual items was 1 - very important to 7 - not important at all. The data obtained through the questionnaire were processed using the Kolmogorov-Smirnov test, the calculations were performed using SPSS at a significance level of 0.5. It turned out that statistically significant differences in terms of gender in the overall assessment were not demonstrated, they were found only in two items. In the item "having a feeling of acceptance and that I belong somewhere" in a group of respondents, they found that women put statistically significantly more emphasis when choosing an employer on the

feeling of acceptance in the work environment and belonging to the work team or as part of the company. They explain the finding by saying that men get this feeling more often and more fully, while women perceive this aspect of work much more sensitively. The second statistically significant finding in the different perception of importance was found in the item "having security and stability in employment". They also assumed the same reason for this finding - women are very sensitive to their job classification, job security and job stability, also on the basis that they are still considered "risky" employees in our society, e.g. from the point of view of future motherhood or the risk of single parenthood, when they can become single mothers and the like. As can be seen, also according to our findings, the seven strategies of Harvard Business Review (Fernandez, J., Lee, K. and Landis, J., 2023) can help by increasing the sharing of information in order to alleviate the fear of uncertainty especially of Gen Z women.

Later in the same year, the authors of the study investigated the special expectations of IT sector employees from employers in the digital era. There were 50 employees of the IT sector as respondents, of which 35 were men and 15 were women. The data obtained through the questionnaire were processed using the Kolmogorov-Smirnov test, the calculations were performed using SPSS at a significance level of 0.5. The authors found that in terms of the age of the respondents, in the research set in Dimension 1 Work and working conditions, it was shown that younger respondents most expect from the employer in the IT sector Adequate technologies in the workplace and least expect Training to work with new technologies. In Dimension 2 Superior employees, it was shown that younger respondents most expect Sufficient information about the development of the organization from superiors and least expect Effective feedback related to work performance. In terms of the age of the respondents, in this research set, in Dimension 3 Remuneration, it was shown that younger respondents most expect salary conditions comparable to competing employers and least expect an increase in salary during the employment relationship. In Dimension 4 Employee benefits, it was shown that younger respondents most expect Vacation Allowance and least expect Extra Vacation. The cited authors believe that the most expected item and the least expected item are related - when I can no longer expect an extra vacation, it would be good to have it in the highest possible quality, with the highest possible number of additional activities or in the highest possible comfort with a contribution from the employer. The authors further state that the results of the research on the expectations of IT sector employees from employers in the context of the digital era, based on the Kolmogorov-Smirnov test according to the age of the respondent, did not show statistically significant differences between younger respondents and older respondents, which the authors attribute to the common characteristics of employees in the IT sector. However, the obtained results of the cited research point to the unique characteristics of the younger generation in this specific employment segment. (Treľová and Hlásny, 2023)

5 Conclusion

Generation Z has recently been gradually entering the world of employment and integrating into the workforce. If the company hires young employees, it must know this young generation. We identify with Felix Behm from Germany, who specializes in Generation Z and holds the opinion/He stresses that a manager must put himself in the shoes of young people in order to talk to them at all. Behm talks about 3 key points that form the basis for Generation Z: a) Meaning (means having fun in what they do - 92% of young people say that my job must be fun), b) Appreciation (sometimes with a cuddle factor because Zoomers grew up with likes), c) Perspective (personal development, because they are often still involved in too many possibilities in the world and uncertainties) (Behm, 2023) As Wittmann (2023) states, the rising generation is relatively relaxed when it comes to career and possible job changes, strives for self-realization and independence, desires to constantly develop, emphasizes the importance of family and friends. Flexible working model, meaningfulness of work, good working atmosphere and fun at

work are the most important for them, even a higher financial reward is not enough motivation for them.

We are convinced that employers must be aware that if they want to attract young talents and keep them in their jobs, they will have to really accept and accommodate the preferences of representatives of Generation Z. They will need to show care for this young workforce. As the number of employees belonging to Generation Z grows, employers and company management have to face the following challenges:

- determination of a suitable working model
- creation of a generationally favorable and cooperative environment - inclusion of the young generation and creation of a single work team
- method of mutual communication on a horizontal plane (intergenerational communication of fellow employees)
- method of mutual communication in the vertical plane (intergenerational communication between a subordinate and a superior)
- modification of the work environment - the issue of the intergenerational workplace (connecting generations as stated by Fernandez, Landis, and Leesedem (2023) e.g. by creating a mentoring program with Millennial and Gen X employees, by creating a partner or buddy program in which Gen Z team members are paired to always had someone to turn to for support)
- internal company culture - building a culture of belonging
- increasing the support and engagement of the young workforce (engaging with the possibility of submitting proposals and presenting ideas, creating opportunities) - preventing the "quiet quitting" trend
- encouraging and maintaining the motivation of the young workforce
- increasing awareness - introducing a policy of open communication (dialogue)
- focus on individual development - ensuring the continuous development of the young workforce
- introduction of a policy of transparency in the area of recognition and remuneration
- providing regular, direct, substantive (short) and constructive feedback and also receiving it
- make aware of their importance, meaningfulness and contribution in the performance of tasks in the team
- avoiding strong criticism – a milder approach when expressing dissatisfaction with work performance
- adaptation of the management style - providing more space and autonomy to explore and discover improvements in work processes
- increasing mental health care - finding ways to increase the mental well-being of Generation Z and thus prevent stress and burnout that affect work performance.

Although we have generalized the above expectations and challenges to the entire Generation Z, it is important to remember that in this generation, as in others, there are individuals who may hold different values and have different expectations. Individual approach plays an important role.

In conclusion, we would like to state that it is a challenge for the manager to integrate the new workforce into a multigenerational work environment. Pendell and Vander Helm (2022) emphasize that employers and managers play an important role in connecting new employees early in their careers with the employees of their organization. As Berger (2021) states, employers who understand how to approach the young generation and manage Generation Z employees accordingly not only open the door to the next generation, but also secure the young talents of tomorrow.

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ORGANIZATIONAL AUDIT AS A TOOL FOR INCREASING COMPANY PERFORMANCE: A QUALITATIVE SURVEY OF ORGANIZATIONAL AUDITS' RESULTS AND RECOMMENDATIONS IN MID-SIZE CZECH COMPANIES

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This paper is a partial output of the project of the project VŠTE v Českých Budějovicích, "IVSUPS2303 - Identification of elements of ethical management and CSR in SMEs".

Abstract: The main objectives of organizational audits include critical and independent evaluations of the appropriateness/purposefulness of the companies' organizational layout and personnel organization with regard to their function and strategy, as well as identifying and eliminating possible performance weaknesses, mainly bottlenecks and overemployment, related to its organizational structure and work-flows. Their purpose, at the same time, is to provide an objective recommendation concerning the possibilities of a better alignment of company structure and strategy, simplifying the flow of main company processes, increasing the effectiveness of its management, and thus promote the overall company performance. The goal of the article is to survey the criteria and methods that organizational audits use for company structure evaluation and, using the method of a qualitative survey, conducted in mid-sized companies in the Czech Republic, analyse the results and recommendations of organizational audits carried out in these companies including their contribution to their performance and management efficiency. Also, the article seeks to identify the main preconditions for a successful organizational audit as well as the main requirements concerning the use of its results.

Keywords: organization audit, HR audit, organizational structure, organizational strategy, methods of organizational audit, organization audits recommendations

1 Introduction

Audits dealing with personnel aspects of organizations most often have three basic forms (Nerantzidis, et al., 2020; Olalla & Castillo, 2002). These cover the human resources audit, the audit of the company's personnel management processes, or some of them (for example, the processes, criteria, and methods of performance remuneration) and the organizational audit (Samagaio & Felício 2023; Turetken, et al., 2019). Other specialized and less commonly used forms of audits dealing with personnel issues include the audit of personnel risks of the organization and the audit of internal communication within the company (Urban, 2017; Urban, 2018). The common goal of all personnel audits is to increase the company performance, increase the quality of its products and services and/or reduce the personnel costs of the organization (Bieliaieva, 2019; Parker, et al., 2020).

The main objectives of organizational audits include critical evaluation of the appropriateness/purposefulness of the overall organizational structure including its parts, e.g., divisions, department etc., as well as evaluation of the appropriateness of individual job descriptions, given the function and the strategy¹ of the organization, aiming at the optimization of the organization structure (Painoli & Losarwar, 2011). Another important objective of the organizational audit is the identification and elimination of company performance problems and weaknesses related to its organizational structure and personnel organization. Examples of these shortcomings can cover process bottlenecks, extending the duration of the main company processes, or, conversely, overemployment, i.e., possibilities for reducing personnel costs without a substantial impact on company performance and/or quality of its production (Eulerich & Eulerich, 2020; Johnsen, 2019).

An important task of the organizational audit in this regard is also the analysis and evaluation of the division of tasks and activities between individual company departments and their organizational coordination, the division of decision making powers and responsibilities among company managers, as well as the analysis of the company quantitative personnel ratios, e.g. the ratios between the numbers of individual categories of employees, for example the ratio of production, maintenance and administrative personnel, the number of managers and executives with regard to the overall number of company employees etc. (Abu Salma, et al., 2021).

Optimization of the organizational structure can be achieved also by simplifying an overly complex organizational structure, both vertical and horizontal, by strengthening the decision-making powers of lower managers that do not correspond their responsibilities, by limiting a too high specialization of jobs, increasing demands for both headcount and internal communication etc. (Khan, & Subhan, 2019).

The organizational audit should not, therefore, be confused neither with an audit focusing on individual skills of company employees and/or managers, nor with the audit of the effectiveness and efficiency of personnel management processes, i.e., the human resources audit and human resource management audit, mentioned above even though organization shortcomings associated with a dysfunctional organizational structure and management skills of its crucial executives can be interrelated (Khashman, 2019; Muhammad & Shamsi, 2019).

An important goal of the organizational audit is usually the evaluation of the expediency of the company departments and personnel capacities in relation to their tasks. Overemployment, increasing its personnel costs, however, may not always be a result of a low personal performance of employees, as sometimes assumed. Indeed, even if the organization audit identifies overemployment as a problem of the company or its parts, it can be the result of an inappropriate, e.g., unnecessarily complex organizational structure, as well as its internal activities duplications, low decision-making powers, excessive specialization of jobs, etc., all of which usually increase demands on human resource capacities (Kuzmin, et al., 2019).

In terms of methods, the organizational audit relies on several information sources, analytical methods as well as criteria used for companies' structure evaluation. Ideally, it should, therefore, be conducted as a joint project combining independent external and internal forces. i.e., it should be conducted in by external auditors in cooperation with the company internal audit and human resource management function department and have a full support of the company top management (Bitkowska, 2020).

The results of the organizational audit should cover proposals for organizational optimization measures leading to increasing the performance of the company or its sections, i.e., increasing its productivity, lowering its costs, increasing the quality of its products or services, promoting the satisfactions of its customers and employees, and reducing the time required by its main processes. These measures can be both short term which can be realized more or less immediately, and long term which require certain time and preparations (Kumar & Harshitha, 2019; Mattei, et al., 2021).

These proposals for changes of the organizational structure of the company or its parts should, more specifically, be aimed at the contents, goals and relationships between/among individual organizational units, recommendations regarding the optimal (limit) personnel capacities of the main organizational units (creation of a new organigram), proposals for a new definition of management powers and responsibilities (e.g. strengthening the flexibility of decision-making by increasing signature

¹ This goal comprises usually checking whether the company applies the principle coined by A.D. Chandler (Chandler, 1969; Chandler, 1984) in 1969 that states that "structure follows the strategy". This means that organizational structure of a company including its divisions, departments, teams, processes, and positions should be designed to support the achievement of the firm's strategy.

authorizations at individual levels of management), changes in the content of activities and performance criteria of key (mainly managerial and specialized) job positions, etc. (Cordery & Hay, 2022, Jurásek et al. 2021).

Contents wise, important tools of these proposal and measures cover the simplification of the management and communication structure, reduction of headcount and elimination of organizational and work duplication (Lavouras, 2020, Ližbetin & Čaha). However, the recommendations of an organizational audit can also lead to the strengthening of employee motivation (for example, through higher decision-making powers, the introduction of teamwork, etc.), the removal of certain organizational barriers preventing higher performance (e.g., communication problems) and the completion of the company's structure, e.g., by introducing of departments and jobs strengthening the customer orientation of the company (Torres, et al., 2016).

2 Theoretical backgrounds: literary research

Criteria of organizational audit

The criteria for the organizational structure evaluation are an important starting point of its execution (Rani & Singla, 2015). The audit is usually based on several criteria which can differ in terms of their importance. These criteria can be regarded as requirements the company structure should fulfil, due to the company strategy, functions, processes etc. (Aydiner, et al., 2019; Christ, et al., 2021).

The evaluation of the appropriateness/expediency of an organization's structure can thus be based on the following needs and/or criteria (Shiri, 2012, Vadasi, et al., 2019):

- the company strategy and its changes (Chandler, 1969),
- strengthening the company client orientation including the need to acquire new customers,
- changes of work or technological processes,
- introduction of new activities/products/services,
- penetration into new markets,
- strengthening the company process/project focus
- creation of process-homogeneous units/management lines
- introduction of clear responsibility for processes
- coordination, or lack of coordination of important activities, simplicity or, on the contrary, unnecessary complexity of their coordination,
- clarity of goals and duties of organizational unit definition,
- reduction of the number of organizational interfaces, i.e., places where a process flow continues in another department,
- creating a leaner and more flexible organization
- shortening and simplifying communication and decision making,
- increasing performance/reducing costs, i.e., increase in performance requirements (work pace, work intensity, use of working time, etc., use of internal synergies
- overlapping of jobs' as well as organizational units' activities,
- reduction of the number of the company's external units,
- outplacement of the "non-core activities", i.e., concentration of the company on its key processes and outsourcing the support processes in which the company cannot keep pace in terms of productivity.

Other criteria that an organizational audit may focus on cover the productivity of the organization and its development, the number of employees, the amount of personnel costs and their development, customer satisfaction, the number of customer complaints and their causes, number of senior employees and its development, the duration of important activities, the running times of the organization's main processes and their development, fluency of the main processes (Górski & Woźniak, 2021).

Information sources, aims and methods of organization audit

The information sources of organization audits cover both the organization's written documents, especially its strategy, organizational charts, job descriptions, existing and/or planned personnel capacities, and qualitative questionnaire surveys, conducted among employees and/or managers, focused on the clarity of work tasks, compliance of their deadlines, control of their fulfilment, changes in work tasks, occasional execution of unnecessary work, work intensity and its development, workload, work duplication, work motivation and management skills of superiors, use of synergies etc. (Roussy, et al., 2020; Erasmus, et al., 2020).

The aim of these methods is to analyse the effectiveness of jobs and company departments in terms of their duties, capacities, and mutual relationships as well as to collect information from company employees concerning eventual weak points in the company structure and its activities coordination. (Lateef & Omatayo, 2019).

Further, mainly quantitative analytical methods of the organizational audit, cover the analysis of selected performance indicators of organizational units, their development and their comparison with comparable companies, real time analyses of the work and work time of company employees (time-sheets, daily time snapshots etc.), mapping of the main processes of the organization, based on the creation of their process diagrams, analysing their efficiency and possibilities of optimizing process flows, calculation of selected indicators characterizing the organizational structure and personnel-organizational benchmarking etc. (Hilkevics & Semakina, 2019).

The above-mentioned methods, both quantitative and qualitative, focus primarily on (Shrestha, et al., 2019):

- the expediency of the company's organizational structure, i.e., the effectiveness of its both vertical (hierarchical) and horizontal structures with regard to company strategy, goals, main activities, performance problems, savings needs, etc.,
- the effectiveness of individual departments of the company and their personnel capacities based on their objectives, the effectiveness of individual jobs and identifications of staff reduction possibilities based on scope of work tasks and workload of individual departments and jobs,
- powers and responsibilities of senior employees and managers including the distribution of powers and responsibilities between the main management positions and organizational units,
- relationships between the organizational structure of the company and the course (flow) of its main processes, i.e., the extend in which (sub)processes are/can be managed within one company department,
- the number of management levels and average spans of control (numbers of subordinates per manager) and their comparison with comparable companies,
- relationships between the number of employees in individual sections of the company,
- selected characteristics of the organizational structure of the company, e.g., the degree of centralization of corporate decision-making, the average management margin, i.e., the ratio of senior employees to the total number of company employees, ratios between individual categories of employees, for example operational and administrative, etc.
- specialization levels of individual jobs,
- organizational bottlenecks demanding an increase in personnel capacities.
- work and management duplicities or multiplicities,
- personnel capacities of administrative and support processes and assessment of the possibilities of their centralization,
- the possibility of outsourcing secondary activities of the company, etc.

Mapping and effectiveness analysis of organization processes: promoting a process-based management

An important goal of an organizational audit is the analysis of company processes looking at the possibilities of increasing the effectiveness of their management (Zaini & Saad, 2019). This goal can be regarded as a first step towards the introduction of process based/oriented management (Harmon, 2019).

The main objective the process-oriented management is to support the customer orientation of the company, both externally and internally, i.e., within the organization, introduce a clear responsibility for processes management including their results. This requires the management based on performance goals, i.e., goals set for individual processes (Groß, et al., 2019; Groß, et al., 2021).

Additional goals of a process-oriented management cover reduction of the number of management levels and organizational interfaces, shortening and simplification of decision-making and communication paths (decentralization of decision-making), shortening the duration of processes and reduction of errors arising from imperfect coordination of activities belonging to a process (Andreev, et al., 2020; Wang, et al., 2019).

The introduction of process management is an opportunity for analysis and overall streamlining of processes, i.e. change or clarification of process goals better adaptation of the process to customer requirements (specification of the outputs of individual processes) defining indicators measuring the results of the process delineation of weak points of processes, making the process more transparent and changing the content, i.e. strengthening some activities, possibly introducing new activities, removing unnecessary activities, new setting of optimal (limit) work capacities of processes determination of a more appropriate method of measuring results, or performance of processes/definition of their efficiency criteria reduction of process costs, better use of resources and capacities tied to the process as well and process standardization (Kumar & Harshitha, 2019; Zaini & Saad, 2019).

This analysis should thus identify the weak points of processes, especially missing and redundant activities, preventing the smooth running of processes or weakening the results of the organization (Suša Vugec, et al., 2020). By creating and analysis of the process map, the organization audit can help in outlining a new course of company processes including their performance indicators as well as a new course of sub-processes designed in an analogous way (Duchek, 2020; Zaini & Saad, 2019).

3 Methodology and Data

The main purpose of the analytical part of this article, based on a qualitative analysis using management questionnaires and semi-structured interviews, mainly with top and/or human resource managers of mid-sized and bigger businesses as well as several mid-sized public organizations which have undergone an organizational audit, was to find out the benefits/value-added of this procedure.

The research thus was focused on the findings and recommendations of organization audits as well as on the companies' evaluation of their results. i.e., their contributions to organizations' effectiveness and performance.

More specifically, the research questions covered the following issues:

- (i) did the organizational audit in the subjects researched found possibilities of substantial organizational structure improvements?
- (ii) what were the typical/most common findings and recommendations of organization audits?
- (iii) did the organizations surveyed accept and apply the findings and recommendations of organizational audits?

- (iv) did the application of organization audits recommendations, according to companies' managers, improve the effectiveness of their organizations?

Data collection was conducted in the second and third quarter of 2023, the organizations surveyed operated in Bohemia and Moravia. A total of thirty-four organisations were surveyed all of which had recently decided to undergo the organization audit to optimize its organizational structure, to increase the internal coordination of its activities, improve the cooperation between/among its units, find possibilities of personnel reductions and increase its customer orientation.

The number of employees in these organizations ranged from 234 to 587 persons, out of the total number of thirty-four organizations thirty were private companies operating in manufacturing, logistics, trade, finance and personal services, the remaining 4 organization operated in the public sector.

4 Results

The research, concerning the outcomes and benefits of organizational audits, based on the analyses of the questionnaires' answers and semi-structured interviews statements, came to the following findings.

- (i) in most subjects researched (in more than 85 percent of them) the organization audit did indeed, as their managers admitted, found substantial possibilities of structural improvements,
- (ii) as for the most common organization deficiencies identified by organizational audits in both private companies and public organizations, in more than two thirds of subjects researched the audits found:
 - too high hierarchy of the organization, i.e., a relatively large number of management layers as well as management positions in relation to the number of employees, and thus a small average span of control.
 - Also, the tendency towards hierarchy was often motivated by personnel and not organizational requirements, i.e., by trying to create positions with higher salary evaluation or higher prestige for certain employees, regardless of the interests or goals of the organization. The result was not only higher costs, but also unnecessarily long decision-making and lower organizational flexibility.
 - excessive degree of job specialization. Excessive specialization leads to the fact that the work capacities of the people who perform these functions are not fully utilized, and causes a higher burden on intra-company communication. The consequence is also a lower degree of mutual substitutability of workers, adversely affecting the flexibility and customer orientation of companies. The audits showed that these problems were quite common,
 - unclear or inappropriately defined goals and responsibilities of both jobs and departments. More specifically, the goals/expected results of departments and jobs were not projected into specific indicators, and their leaders often confused the goals of their departments with their main activities),
 - the managers or other employees could not influence the goals that have been set for them. Similar problems included overlapping responsibilities or situations when the line (executive) and staff (advisory or methodical) nature of positions and their tasks were not clearly distinguished,
 - high numbers of employees of support and administrative departments. It occurred mainly when the numbers of these workers were determined without a closer relationship to the actual need for administrative and methodical support of the main organizational units. As a rule, those methodical departments lacked any direct contact with customers,
 - low centralization of support functions (e.g., purchasing), leading to the fact that practically the same activities are performed simultaneously in different organizational units,

and the organizations in question suffered from low use of synergies,

- uneven distribution of controlled areas between the main leadership positions.

In more than half of companies surveyed the organization deficiencies found by the audit were:

- long decision-making processes and low decision-making competences (decision-making is unnecessarily long because decision-making competences do not correspond to the management positions which reduces the flexibility of the organization),
- uneven distribution of managed areas between managers,
- areas of work duplications.

As for the organization audits recommendations (specific organizational changes and management steps suggestions to be taken to improve organizations' effectiveness), the typical recommendations (which occurred in more than three quarters of the organizations surveyed) following the deficiencies mentioned above were:

- reduction in the number of management positions,
- changes in the activities, goals and/or performance criteria of individual departments,
- changes in relationships between/among departments,
- changes in the scope of personnel capacities of the main organizational units as well as individual departments, e.g., setting maximum number of positions in individual departments,
- integration of organizational units within the company structure facilitating their cooperation with related departments,
- changes in job descriptions in terms of job purpose (goal), main powers and responsibilities, activities, and performance criteria of key job positions,
- increasing signature authorizations at individual management levels,
- introduction of clear personal responsibilities for processes
- streamlining of company processes and better alignment of company processes and its structure,
- outsourcing of too costly supporting or ancillary activities outside the company.

- (iii) Most managements of the organizations surveyed (72 percent of them) claimed that organizational audit was a useful and thus recommendable procedure. More than half of them stated that these findings can be regarded as areas on which their organization should concentrate more in the future. More than half of the subject admitted that the results of the organization audit exceeded their expectations. About two thirds of them were ready to introduce their recommendations, even though sometimes rather in the long run.

The main reasons why organizational audit is a useful tool of company management, the surveyed companies claimed, is the fact that both employees and managers of companies suffer from organizational blindness and tend to keep organizational processes for a prolonged period without major changes. Also, concerning headcount, companies tend to have "built in" tendency of personnel growth, not related to their activities and tasks.

At the same time, however, more than half of the organizations surveyed claimed that, according to their experience, organizational audit, to be effective:

- should be conducted as an external and independent assessment of the organizational structure of the company or an assessment combining the expertise of internal and external personnel. External help is usually necessary both as a guarantee of independency and impartiality of the audit and the professionalism of its methods.

The research found that organization audits carried out either by external companies or with external methodical guidance and guarantee used on average more data gathering and analytical methods the audits conducted purely by internal forces (the average number of methods was 8 compared to 4). Also, their recommendations covered both long term and short term (immediate) measures while, on the contrary, recommendations of audits conducted by purely internal forces only, suggested usually mainly long-term measures.

- the audit should have a clear support of the highest company management and its essential information source should cover anonymous employees questioning needed to gather unbiased information concerning the real organizations' practices,
- companies which decide to undergo an organizational audit should, consider the danger of various, sometimes hidden, forms of resistance against organization audit suggestions. Therefore, it is usually recommendable to motivate employees to support organizational changes as well as to react in advance on their fear of change (44).

- (iv) To summarize these results, it can be stated that the research, based on analysis of managers' questionnaire answers and personal statements, thus came to the conclusion that organizational audit can be a helpful management tool improving organizational effectiveness mainly through reducing personnel costs by critical evaluation of the usefulness and expediency of individual jobs as well as overall personnel capacities of company departments, simplification of organizational structure, and setting clear goals of positions and departments. organizations?

5 Conclusion

An organizational audit is an external and independent assessment of the organizational structure of a company. Its main task is to assess the effectiveness of the organizational and personnel structure regarding how much it contributes to the achievement of the company's goals, facilitates internal cooperation, does not increase personnel costs, does not hinder flexible decision-making, customer orientation, etc.

The main goal of an organizational audit does not have to be personnel reduction. Even in the case when the audit finds overemployment, it may not be a consequence of the low personal performance of employees, but also the result of an unnecessarily complex organizational structure, internal duplication, low decision-making powers, excessive specialization of jobs, etc.

The result of the organizational audit are proposals for organizational measures leading to the strengthening of the performance of the company or its departments. It can be proposals for changes in organizational integration, changes in the content, goals and relationships of individual organizational units, recommendations for optimal personnel capacities, proposals for a new definition of management powers or the content of the activities of key positions.

The main benefits of an organizational audit include the simplification of the management and communication structure, the reduction of personnel costs and the elimination of organizational and work duplication. However, the recommendations of an organizational audit can also lead to the strengthening of employee motivation (for example, through higher decision-making powers, the introduction of teamwork, etc.), the removal of certain organizational barriers preventing higher performance (e.g., communication problems) and the completion of the company's structure (e.g., the introduction of departments and jobs enabling strengthening the customer orientation of the company) etc.

Given that the goals and functions of the organization always change over time, the organizational audit can be understood as an important part of "preventive management", i.e., the timely elimination of deficiencies in the organizational structure and processes flows that no longer meet the organization's requirements.

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INTRODUCTION INTO ELECTRONIC COMMERCE ENTREPRENEURSHIP IN THE UNIVERSITY COURSE USING VIRTUAL ENTERPRISES

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Abstract: Entrepreneurship education helps to promote the employment of university graduates and it might be implemented in various fields of business including e-commerce. It may be appropriate for future entrepreneurs in e-commerce to experience the development and management of an enterprise in a virtual form as part of their education. This article aims to demonstrate how are virtual enterprises used for instructional reasons in the university entrepreneurial course. This particular course allows its participants to experience the first phase of the existence of their fictitious e-commerce enterprises. Students establish and manage virtual limited liability businesses operating online stores. Electronic banking software allows the settlement of payments related to their e-commerce business activities. Pre-course and post-course surveys were conducted to investigate changes in students' self-reported evaluation between these two moments. Results show significant improvements in all investigated entrepreneurial aspects of the course suggesting that the given approach of using virtual enterprises for entrepreneurship education positively impacts the entrepreneurial skills, knowledge, and experience of the course participants. This suggests that this design of using virtual enterprises can be a suitable way of implementation in the educational process of entrepreneurship in higher education institutions.

Keywords: e-commerce, entrepreneurship education, university course, virtual enterprise.

1 Introduction

The development of new enterprises has always aided in the continual growth of the productivity in the economy. Education in the area of entrepreneurship and developing students' entrepreneurial mindsets ought to be central to the curricula of academic institutions offering business management and economics degrees (Gerdin & Linton, 2016).

Experience with real-world entrepreneurship is frequently lacking in school (Harris, 1979). Conversely, university studies may be a great time for students to launch their own businesses since they can work with or be employed by their peers, collaborate with them, and obtain real-world experience. Even the failure of the business does not have only negative sides as many prosperous companies emerge from a string of unsuccessful ones (Thiel & Masters, 2014).

Furthermore, participating entrepreneurs get invaluable expertise from unsuccessful enterprises that they might apply to their future professions (as workers or as entrepreneurs). The business world has been impacted by information and communication technology (ICT) in many ways.

1.1 Information and communication technologies in e-commerce

Information and communication technology (ICT) usage currently affects a number of areas of economic life. Entrepreneurs may utilize it for promotion, banking and payment services, product delivery to clients, administration institution communication, business establishment, and more. The emergence of ICTs led to the creation of electronic commerce and enterprises.

The use of information and communication technology to facilitate the electronic exchange of goods and services is known as electronic commerce or e-commerce. E-commerce enables businesses to reach a larger pool of prospective clients by distributing goods and services. Other information and communication technologies (including online marketing, electronic data interchange, electronic money transfers, enterprise resource planning, data collecting systems, etc.) are frequently used in e-commerce.

At least a portion of transactions in electronic business take place online, while other information technologies could also be used. Online marketplaces for consumers or other businesses,

online shopping websites (e-shops) for customers at retail, online marketing and sales promotion, and business-to-business electronic data interchange are examples of e-commerce operations for enterprises (Bakos, 2001).

By definition, electronic payments and banking may be linked to electronic commerce. Electronic banking is characterized by constant, round-the-clock access to payment services. The ability to share information quickly and easily between merchants, banks, card providers, and customers outside of regular business hours. Additionally, virtual transactions may be completed at any time and from any location in the globe thanks to electronic payments. Retailers may save time and money by using this to provide cash flow without the requirement for physical store branches.

Electronic companies frequently need to get in touch with public administration organizations to complete legal requirements, such as filing tax returns and requesting permissions and licenses, among other things. We refer to electronic government (e-government) if this kind of connection and engagement with institutions of public administration is permitted by electronic means. Businesses engage with the government-to-businesses (G2B) level of e-government, also known as the commerce level, which is tailored to meet the unique requirements of companies (Yildiz, 2007).

1.2 Information and communication technologies in e-commerce entrepreneurship education

It is essential to incorporate all of these above-mentioned basic elements while preparing future e-commerce entrepreneurs so that students may gain as much firsthand experience as possible with the running of such enterprises. In addition to the effects on companies listed above, information and communication technologies regularly complement the educational process and aid in students' knowledge and skill development (Akimov et al., 2021).

It involves a lot of effort to include ICT properly in the teaching process at higher education institutions. The advent of e-learning, which is a popular kind of distance learning in the current educational environment, was made possible by information technology. E-learning may enhance other cutting-edge educational approaches or help university instructors become more proficient in ICT (Laurillard, 2005). The usage of e-learning might also help to overcome non-standard situations, similar as what occurred during the COVID-19 pandemic, when pandemic prevention measures made made classical face-to-face teaching impossible (e.g. Almarzooq, Lopes & Kochar, 2020; Bokolo & Selwyn, 2021; Shamir-Inbal & Blau, 2021 and others).

Future entrepreneurs may find that ICT may assist them in analyzing, reprocessing, and improving their business processes to optimize their companies' operations. ICT may also assist education in entrepreneurship (Von Graevenitz, Harhoff & Weber, 2010). Augmentation or virtualization of objects or processes is one of these ICTs which can support the educational process in various subjects of study, for example in biology (Vasiliadou, 2020), science (Alneyadi, 2019), digital media arts (Yingjun, 2021), biomedicine (Fabris et al., 2019), engineering (Ibáñez & Delgado-Kloos, 2018), mathematics (Costa et al., 2018), etc.

Various advanced information and communication technologies are also used in educational processes for a simulation of entrepreneurship (Vanevenhoven & Liguori, 2013), including the virtualization of enterprises. Virtual enterprise or virtual firm means that this company is only a fictitious company serving for educational purposes. Virtual in this case means that this company has no real legal status, but and serves as a pedagogic model.

Butterlin et al. (2014) used the model of virtual firm in biomedicine education for students to work in real conditions on the development of new medical devices and the modernization of medical products. The need for these innovative medical devices was identified by the students during their internship in hospitals and within the framework of the virtual enterprise students developed several products in reaction to this identified need. Keramitsoglou, Litseselidis, and Kardimaki (2023) described a virtual enterprise approach, which can be used to introduce circularity and sustainability in entrepreneurship to the students.

Zhi (2021) developed an education model for cooperative virtual enterprises based on e-commerce with the aim of solving selected teaching issues within the area of entrepreneurship. Blagosklonov et al. (2006) used a virtual enterprise as a role-playing tool which allowed students to gain relevant and practical on-the-job experience. The course participants played the roles of the employees and the applicants for vacant positions at the virtual firm. Their results showed that this concept may be used to improve students' performance and to support their post-graduate integration into the labor market.

Zhang and Zhang (2018) also proposed the use of virtual enterprises for entrepreneurial education in the conditions of China's higher education. They concluded that the virtual enterprise-based education pattern provides more practice capital for the employment of college students including their ability for self-employment. Similarly, Borgese (2011) described the virtual enterprise as a transformative learning methodology very helpful and effective in achieving entrepreneurship education goals.

Therefore, this paper will introduce the possibility of virtual enterprises usage in the educational process of the university course and its contributions to self-reported gains of students' knowledge, skills, and experience with entrepreneurship in the area of electronic commerce.

2 The Course

The capacity to comprehend and apply information and communication technologies (ICTs) is now one of the most important factors of success in e-commerce entrepreneurship. It is based on their ability to become acquainted with a wide variety of knowledge relevant to this sector. This promotes the use of ICTs in the electronic commerce training of potential future businessmen, who need to know how to operate and manage various economic information systems.

In our case, the course of Economic Information Systems (EIS) simulates the business activities of recently founded e-commerce enterprises in a university course. The enterprises have only the virtual (fictitious) character serving for entrepreneurship education purposes within the course. This non-mandatory course is offered to students in their second year of master's degree studies in the discipline of Business Informatics or alternatively in the third year of bachelor's study in the field of Finance, Banking, and Investment. Within the framework of the EIS course, problem-oriented learning, learning-by-doing, and e-learning methods are used. In particular, participants should improve their knowledge of website design, online shop administration and management, legal issues, taxation, and electronic accounting systems. They should also broaden their understanding of electronic communication e-Government methods with public administration authorities.

The EIS course enables the emulation of operating electronic commerce in the context of the Slovak economy through the use of virtual enterprises. The EIS course is built on e-learning technologies, allowing course completion without the need to attend lectures in person. Face-to-face components of the course are primarily consultative in nature and are not required of students. Through the creation and management of virtual businesses, the course gives students the opportunity to practice the fundamentals of entrepreneurship in the electronic commerce sector. One-person limited liability companies are a fairly frequent type of business in the context of local business reality.

Students have a limited opportunity to establish a virtual enterprise operating an online store within one of three categories of items (computer equipment, office equipment, or office furniture) as part of their entrepreneurial activity. The central faculty business, run by lecturers, acts as a wholesale outlet where enterprises owned by students may purchase their virtual items to resell.

Students set up their own enterprises in accordance with Slovak Republic legislation. To simulate public administration institutions (specifically: business register, trade register, tax office, social insurance office, and health insurance institution) lecturers run a virtual online registration authority. Course participants are obliged to electronically communicate with these institutions using a digital signature during the process of establishing their companies. The Sectigo certification authority issues certificates to students for digitally signing relevant documents. It is required of students to draft a business plan for their enterprise's initial periods. Making the webpage of the enterprise and uploading it to the web server hosted by the university is a further essential phase.

The e-shop, which houses the company's whole product line, is a crucial component of the website. Lecturers supply students with a preinstalled open-source e-shop solution, which students must further customize it to meet their requirements. Students are required to maintain their e-shops until the conclusion of the semester and fill them with their items. The central online wholesale e-shop (administered by lecturers) is the source of the goods within the environment of the EIS course. Other students are also imitating their customers by purchasing items that aren't listed in their online stores. Here, they take on the role of private individuals to create some demand for the commodities. Teachers who make purchases from students' e-shops also contribute to the demand. Faculty's virtual bank, which also offers all businesses startup financing, is used to process payments for sales made in e-shops.

Students are obliged to record all of their activities in accounting before the EIS course is over. This part of the EIS course uses an educational version of local accounting software. Developing the company's strategic plan for the coming years is the last assignment within the course. It also includes suggestions for modifications to their company's procedures and outlooks for their virtual enterprises. Students provide instructors comments on the course after the course.

Learning Management System (LMS) Moodle is used by students primarily to access educational content during the course. Our educational organization uses standardly LMS Moodle for e-learning reasons. Additionally, it facilitates simple communication with the course participants. LMS contains the course schedule as well as all assignments. Similarly, instructors supply all of the study resources here. Through LMS Moodle, students may verify if they are meeting the deadlines for the course and also get their assignments graded. Several of the assignments are submitted straight into the LMS by students and assessed by lecturers subsequently.

Students are obliged to digitally communicate with virtual public administration authorities while setting up their virtual enterprises. The virtual registry represents these authorities and students must use electronic communication to interact with them. All procedures and legal documents are updated under the current Slovak legal order. Students must register their enterprises in the Business Register and their upcoming business activities with the Trade Licensing Register. Subsequently, the course participants must register their businesses with the Social Security, Tax, and Health Insurance institutions. All required paperwork is available online, and once completed, they can be sent to the virtual office using the virtual registry.

These documents require a digital signature for authorization. A significant portion of the course is devoted to the topic of digital signatures in electronic communication. Additionally, a brief description of potential usage for digital signatures in various e-government domains is given to the course participants.

Furthermore, topics of encryption, digital communication, and Public Key Infrastructure are shortly introduced to students.

For issuing private certificates for digital signing, the Sectigo certification authority services are used. Adobe Acrobat Reader is subsequently used to sign documents in PDF format. The EIS course's practical application of digital signatures entails signing all required electronic papers and submitting them to the appropriate virtual authorities.

The establishment and administration of an electronic shop, where all the products of virtual enterprises are merchandised, is the primary focus of the EIS course's e-commerce module. All products originate from the primary wholesale e-shop, which is run by lecturers. The products are entirely virtual and are created with no production expenses within the central wholesale store's inventory. Student-run enterprises purchase products for their online shops based on the item categories (computers, office supplies, office furniture, etc.). The item category is chosen by students in early registration of their virtual enterprise. Students should purchase products from the e-shops of other students from two different categories of commodities supplied to mimic demand for their goods and to outfit their company's virtual workspace with furnishings or equipment. Additionally, lecturers increase demand by making sporadic purchases from each student's e-shop.

Students are required to promote their enterprise online as well. The primary marketing tool for their enterprise, a website should be intended to attract visitors to purchase things from the firm's online shop. Customers who are interested in purchasing products from a particular company should visit the website's e-shop section and register there. Following enrollment and login, a traditional online purchasing procedure is employed. After choosing items from multiple groups in the virtual shopping cart, the customer checks out and continues with online payment. In this section of the course, its participants use virtual enterprises to experience both - the selling and purchasing processes on both (customer's and administrator's) sides of the e-shop.

The online payment system of our virtual bank is used to process electronic payments that facilitate the buying and selling procedure in e-shops. This bank is based on the antiquated version of banking software donated to our institution for free. This bank provides virtual loans to students to facilitate the purchasing and selling procedure. When an online payment is made in the e-shop, the buyer is redirected to the bank's internet banking where the payment's parameters (for the purchase) have already been filled in. Digital signatures are supported as an authorization element in the online payment system of virtual banks as well.

Digital signatures are supported as an authorization element in the online payment system of virtual banks as well. A digital signature is also used to enable bank user identification. The main concern in the e-purchasing procedure is the security of the entire payment process. Course participants become familiar with this essential phase of e-commerce through the actual usage of online payments. Technology is advancing to provide safe online payment methods. The subject of users' safe behavior also pertains to the safety and security of their usage. Customers should, at the very least, abide by safety guidelines while making payments online.

The primary concern in the EIS course with online payments was connecting e-shops to essentially separate virtual bank systems so that payment data could be automatically sent from e-shops to banking systems. The course participants are to configure an account number in the e-shop management menu.

3 Materials and Methods

As part of gathering feedback for the Electronic Information Systems course, a survey concerning students' experiences with e-commerce entrepreneurship, electronic communication, and electronic payments was undertaken in the most recent course instance. Both before and after the course ended, a survey was

conducted. Investigated were the students' understanding of and experience with starting and running small trade enterprises, electronic payments, electronic commerce, and digital interaction with public administration. The survey's findings provide pertinent recommendations for enhancing the EIS course's educational process. The survey was conducted online using a web questionnaire and respondents were contacted using a link in the course in the LMS Moodle. Fulfillment of the questionnaire was mandatory for the course participants in order to acquire credit. Therefore, a complete sample (84 students) of participants answered the questionnaire that was recovered in both surveys (pre-course and post-course). All respondents were students of the face-to-face form of study participating in the EIS course in the academic year 2023.

Gathered data were subsequently tested for normality of distribution (Kolmogorov-Smirnov test) and further nonparametric test (Wilcoxon signed-rank test) was used for testing if the difference between pre-test and post-test data was statistically significant. Wilcoxon signed-rank test is a standard statistical test used in the case of testing the differences when data are normally distributed (Weiss, 2012).

The age composition of the respondents' sample was similar to the age composition of all students in a given year of study at our educational institution. However, the majority of respondents were students in age between 18 and 20 years old. The gender composition of the group of respondents shows that over 53 percent of our survey respondents were women. This reflects also the composition of students in our faculty. In Slovakia, the accessibility of broadband internet services is frequently influenced by one's residential region; larger cities tend to have higher coverage. More than one-third of responders are from smaller communities with less than 40,000 residents, where access to broadband internet may be more limited. All relevant demographic data gathered is available and shown in the following table.

Tab. 1: Demographic data on surveys respondents

	Count	Percentage
Age		
18 - 20	69	82.1
21 - 23	13	15.5
23 and over	2	2.4
Total	84	100
Gender		
Male	39	46.4
Female	45	53.6
Total	84	100
Residence		
Large-sized city (over 100,000 citizens)	65	77.4
Medium-sized city (40,000 to 100,000 citizens)	6	7.1
Small town (5,000 to 40,000 citizens)	8	9.5
Village (under 5,000 citizens)	5	6.0
Total	84	100

Source: authors

Respondents in the survey had to express their agreement with the provided statements regarding the process of setting up and managing their small enterprises. The same set of statements was used in both pre-course and post-course surveys to reveal any shifts in their self-reported knowledge, skills, and experience in these entrepreneurship areas. The level of their agreement with the given statement was expressible for respondents on a 5-degree Likert scale with standard levels (i.e. minimum at 1, maximum at 5 with meaning: 1 - strongly disagree, 2 - disagree, 3 - neutral, 4 - agree, 5 - strongly agree).

4 Results

The following table provides a comparison of students' pre-course and post-course levels of agreement with several statements regarding the processes of functioning of a small e-commerce enterprise.

Tab. 2: Pre-course and Post-course self-reported evaluation of experience with selected aspects of entrepreneurship

Survey Statement	Pre - Course		Post - Course		Wilcoxon signed-rank test - 2-tail. sig.
	Mean	Std. dev.	Mean	Std. dev.	
I can establish a small enterprise according to legal requirements	2.31	1.22	3.57	0.97	0.035
I can prepare a business plan for a small enterprise	2.84	1.50	3.98	1.48	0.030
I can use eGovernment services for enterprises	1.99	1.97	3.28	1.65	0.041
I can prepare web presentation for a small enterprise	2.02	0.99	3.53	1.1	0.023
I can manage and administer an e-shop for the e-commerce needs of a small enterprise	2.38	1.29	3.45	0.89	0.037
I can manage the accounting records of a small company	2.57	1.15	3.32	1.03	0.012
I can prepare a strategic plan for a small enterprise	2.19	1.48	3.78	1.22	0.008
I am considering starting my enterprise in the near future	1.95	1.65	3.09	1.44	0.048

Source: authors, Note: N=84, $\alpha=0.05$

There can be considered five ranges for the interpretation of means within the 5-degree Likert scale by dividing the full range from 1.00 to 5.00 by 5 degrees of agreement. This division creates 5 ranges with 0.8 widths, namely: strongly disagree with the statement is the meaning for means within the range from 1.00 to 1.80. Respectively, disagree for means within the range from 1.81 to 2.60, neither disagree nor agree for means within the range from 2.61 to 3.40, agree for means within the range from 3.41 to 4.20, and finally strongly agree for means within the range from 4.21 to 5.00. It is suitable to use mean to demonstrate the difference between two groups of respondents when trying to compare their central inclination on the Likert scale (Liddell & Kruschke, 2018).

The normality of the distribution of gathered data was tested using the Kolmogorov – Smirnov test to choose the proper test for testing the significance of the difference between pre-test and post-test data. The Kolmogorov-Smirnov test's results (test statistic 0.091, $p=0.033$) showed that the data are not normally distributed, therefore nonparametric test was used further (Ghasemi & Zahediasl, 2012).

Wilcoxon signed-rank test is a nonparametric method used to test whether the mean values of two dependent groups differ significantly from each other (Weiss, 2012). In this case, the Wilcoxon signed-rank test was used to detect the differences between pre-course and post-course self-reported levels of agreement with the given statement. The results in Table 2 with significance levels below 0.05 are statistically significant at the level of $\alpha=0.05$, meaning there is a statistically significant change between pre-course and post-course rate of agreement with the particular statement (Weiss, 2012). Hence, our gathered data can be interpreted as follows.

Respondents at the start of the EIS course did not believe to a large extent (mean=2.31, disagree range) that they could set up a small enterprise strictly according to local legislative conditions. After the course completion, their self-reported agreement in this area rose to the level of 3.57 (agree range). According to the Wilcoxon signed rank test, this is a significant (at a level of 0.035 which is below $\alpha=0.05$) increase in their confidence in establishing a small enterprise.

Before the beginning of the EIS course students stated a neutral stance (mean=2.84) when referring to their ability to prepare a business plan for their company. At the end of the course, they reported significantly higher confidence (mean=3.98, agree range) in their ability to prepare such a business plan. The Wilcoxon signed rank test indicated this growth as significant (at a level of 0.03 being less than $\alpha=0.05$).

At the beginning of the EIS course, the participants did not suppose (mean=1.99, disagree range) intensively that they could use eGovernment services for enterprises. Their self-reported agreement in this area increased to 3.28 (neutral range) after the course ended. The Wilcoxon signed rank test shows that their confidence in using eGovernment services for enterprises has increased significantly (at a level of 0.041).

Respondents at the beginning of the EIS course did not assume on average (mean=2.02, disagree range) that they can prepare web presentation for a small enterprise. After the course completion, their self-reported agreement with this statement increased to the level of 3.53 (which is in the agree range). According to the Wilcoxon signed rank test, this was a significant increase (at a level of 0.023).

Before the start of the EIS course, participants did not feel (mean=2.38, disagree range) that they could manage and administer an e-shop for the e-commerce needs of a small enterprise. Their self-reported agreement in this area increased to 3.45 (agree range) after the training in the course ended. The Wilcoxon signed rank test indicates this growth as a significant (at the significance level of 0.037) increase in their confidence in managing a small enterprise's e-shop.

Respondents before the EIS course were not confident in (mean=2.57, disagree range) that manage the accounting records of a small company. At the end of the course, they self-reported agreement on an average of 3.32 (neutral range) being significant (Wilcoxon signed rank at level of 0.012) increase in their confidence in managing the accounting records of a small enterprise.

At the beginning of the EIS course, the participants did not suppose to a large extent (mean=2.19, disagree range) that they could prepare a strategic plan for a small enterprise. Their self-reported agreement in this area improved to 3.78 (agree range) after the course ended. According to the Wilcoxon signed rank test, this is a significant (at a level of 0.008) increase in their self-assurance in preparing a strategic plan for a small enterprise.

Before the start of the EIS course participants did not consider starting their own real-life enterprise in the near future (mean=1.95, disagree range). After the course completion, their self-reported willingness to start their own business increased to the level of 3.09 (neutral range), confirmed by the Wilcoxon signed rank test as being a significant (at a level of 0.048) increase.

Our results show that in all investigated aspects of the functioning of a small enterprise, the course participants increased their self-confidence. This fact suggests that their knowledge, skills, and experience in entrepreneurship have increased during the course attendance. Though in three statements (i.e. I can use eGovernment services for enterprises, I can manage the accounting records of a small company, I am considering starting my enterprise in the near future) students' rate of agreement still did not reach the agree level at least.

At the end of the course, the survey had an additional statement asking respondents if they would recommend the EIS course to other students. The average rate of agreement of course participants with this statement was at 4.02 being in the agree range. This suggests that students appraised the EIS course positively and they would recommend to the other students to choose this non-mandatory course from the educational institution's curricula.

5 Discussion

Educators use virtual enterprises commonly for their educational purposes in the field of entrepreneurship. The design and implementation of the virtual enterprises must be adjusted for the needs of the particular course of educational area. The role of virtual enterprises must be adapted in accord with what knowledge, skills, and practical experience should virtual enterprises develop in each individual course. The success of the educational intervention using virtual enterprise might be investigated in several different ways. In this case, the students' self-reported evaluation in multiple entrepreneurial activities was used.

The obtained results suggest that our approach of virtual enterprise usage for entrepreneurship education purposes positively influences self-reported evaluation in all investigated aspects of the EIS course. This indicates that the use of virtual enterprises can have a positive impact on entrepreneurship education. These outcomes are consistent with the results of multiple other authors (e.g. Butterlin et al., 2014; Blagosklonov et al., 2006; Zhang & Zhang, 2018 and others).

Self-reported attitudes are standardly used to determine the fruitfulness of the educational intervention. However, it cannot describe its effects perfectly. Especially if the student's results are not compared to a control group without educational intervention.

However, the control group could not be formed due to the design of the course and the university curricula. Therefore, it is not possible to express that these increases were caused strictly by educational intervention within the EIS course.

Efforts to isolate the effects of educational intervention from other influences on the increase of self-reported evaluation of students in investigated areas of entrepreneurial activities might be the topics for further enhancement of the research.

Furthermore, our course is dedicated to the electronic commerce area of entrepreneurship with all its specifics. Possibilities of similar design of virtual enterprises implementation into educational processes within other areas of entrepreneurial education can be further investigated.

6 Conclusion

The inclusion of virtual enterprises in entrepreneurial education especially in the e-commerce domain is an innovative way of using modern information and communication technologies in education. The study introduced our approach to the implementation of virtual enterprises into the entrepreneurial university course in the field of e-commerce.

Pre-course and post-course self-reported confidence of the course participants in several e-commerce entrepreneurial aspects were investigated. This examination has indicated its influence, which has positively improved the students' self-reported evaluation of their confidence in all investigated entrepreneurial activities related to e-commerce. This may also contribute to their propensity for entrepreneurship and increase their capacity for self-employability. Students valued our course positively and they expressed their willingness to recommend this course to the other students.

Based on the conducted investigation, which aimed at exploring the contribution of our approach to the use of virtual enterprises in entrepreneurship education, it can be concluded, that this educational approach supports the development of entrepreneurial skills, knowledge, and experience of students in the field of e-commerce. However, the specifics of electronic commerce do not allow easy adaptation of our educational approach to an arbitrary entrepreneurial area.

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IMITATION STRATEGIES OF A. TURGENEV'S NOVEL "SO THAT GOD WILL TEAR YOU TO PIECES FROM THE INSIDE!"

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Abstract: The article is devoted to the analysis of Andrey Turgenev's novel "So that God will tear you to pieces from the inside!". The aim is to show the imitation practices of the critic Vyacheslav Kuritsyn, in this case acting as a writer under the pseudonym Andrey Turgenev. The author's "precedent" pseudonym, allusively associated with the name of the Russian classic Ivan Turgenev, gives rise to the idea of a literary game that the critic-writer started to create an imitation text, a "secondary" text. However, the classical Turgenev traditions were ignored by the modern writer, he tried, on the one hand, to combine the techniques of Fellini cinema in the novel text, on the other hand, to reproduce the strategies of the Moscow conceptualists D. Prigov, L. Rubinstein, V. Sorokin, etc. It is shown that along with stylistic mistakes, the merit of the Kuritsyn-Turgenev genre experiment is an appeal to fundamental issues of creativity, a wealth of intertextual references to modern Russian and world literature.

Keywords: Kuritsyn; Turgenev; "So that God will tear you to pieces from the inside!"; genre experiment; Moscow conceptualism.

1 Introduction

Andrey Turgenev is a pseudonym that was chosen for himself by the infamous Yekaterinburg, then Moscow, and later St. Petersburg literary critic, an authoritative expert on Russian postmodernism Vyacheslav Kuritsyn. Probably, in order to distance the credo of the critic and the writer, in order to appear before the reader in a different (mysterious) image, Kuritsyn found a sonorous pseudonym, which, on the one hand, distanced him from the critical pathos of the previous Kuritsyn articles, on the other hand, absorbed obvious connotations to the name and work of the famous Russian writer of the nineteenth century Ivan Turgenev.

As you might guess, for a postmodernist philologist, this technique is a literary game, it is no coincidence that a few years later Kuritsyn will perform under a new pseudonym — Sirin, in order to try on the mask of a novelist of a different style, the early V. Nabokov (see more about this: Bogdanova 2008).

Guessing about the author's pseudonym, the reader initially sets himself up for a postmodern game, which Kuritsyn-Turgenev undertakes. The recipient's task is to discover the tactics of literary game mimicry offered by the novelist and to explicate them in the "secondary" (as one might assume) text.

The rapidity of the birth of Vyacheslav Kuritsyn's novels in the first decade of the XXI century makes us take a closer look at his art-texts. And although Kuritsyn strives to separate himself as a writer from himself as a critic (see more about it: Kuritsyn 2001), the recipient-reader retains an allusive connection with the critical-postmodern strategies of the "venerable" critic and the "novice" prose writer.

How does the "new" Turgenev manifest himself in modern Russian prose? What is the artistic originality of a previously unknown author? Is it possible to talk about the continuation of a truly Turgenev tradition, or is the game in the text-experiment dominant?

2 Literature Review

Few researchers have written about V. Kuritsyn's critical articles and literary texts. Among them are M. Berg (Berg 2000), N. Leiderman (Leiderman 2003), M. Lipovetsky (Lipovetsky 1997), E. Bibergan (Bibergan 2011), O. Bogdanova (Bogdanova 2008, 2019, 2023). These and other studies (Groys 1979, Epstein 2000, Bobrinskaya 1994, 2006, Albert 2014) formed the basis of our study and were involved in the analysis.

3 The practical significance

The practical significance of the study is that its intermediate and final conclusions, individual observations and judgments can be used in further study of the work of Vyacheslav Kuritsyn and modern Russian literature in general.

4 Mixing of Novel strategies in Kuritsyn-Turgenev's text

In the novel "So that God will tear you to pieces from the inside!" first of all, even before getting acquainted with the text itself, its name attracts attention — it is excessively long and intricate. Inevitably, a new question becomes relevant: what does the name imply — an order, instruction, statement, judgment or something else? There seems to be no doubt that this kind of "mysterious" title was chosen by the writer in order to intrigue, interest, and captivate the reader who at least once looked at the cover of the book.

The abstract prefixed to the text strengthens and supports the original intrigue, since it characterizes the novel a priori as "sensational, shocking", as a "bizarre literary installation", besides explicates the main problem of the novel text — "Where does ... art come from?" (Turgenev 2008, 4). As you know, the problem is not new not only for Russian, but also for world literature, and the problem is undoubtedly deep, philosophical, it seems inexhaustible, since time dictates new ways and new forms of creative research, and therefore offers new answers to eternal questions.

It is also curious that already in the annotation Kuritsyn-Turgenev names Fellini, who (as indicated) inspired the author of the novel "to such an experiment with genre" (Turgenev 2008, 4). From everything presented in the annotation, it becomes clear that the novel should be a kind of genre experiment, a kind of a postmodern conceptual construction based on a mixture of literary and cinematographic trends, a kind of text-film that incorporates the intentions of not only different genres, but also different types of arts.

The mixing of strategies of different forms of art, in this case verbal and visual, the designation of genre originality as an "installation" easily leads to the attribution of the novel of Kuritsyn-Turgenev to the practices of conceptual writers. It becomes obvious that Kuritsyn is trying himself in what V. Sorokin and other artists and writers of the so-called "Moscow conceptualism" have already tried themselves in much earlier (Groys 1979, Bibergan 2011, Albert 2014). It becomes clear that Kuritsyn chooses as the rules of the literary game the techniques and strategies of "collective action" by A. Monastyrsky and others (see about this: Bobrinskaya 1994, 2006, Lipovetsky 1997, Epstein 2000, Bogdanova 2023). The only important difference, it seems, is that the combination takes place in a different fantasy series: not painting plus literature, but cinema plus literature. And, as the novel text shows, Kuritsyn offers a much wider range of combinations-comparisons, which will have to be dealt with.

4.1 Structural and compositional features of the novel

The novel "So that God will tear you to pieces from the inside!" consists of six chapters and an epilogue. Each of the chapters is called primitively — by the day of the week and the designation

of the ordinal number of the day. For example, “1st day, Tuesday”, “2nd day, Wednesday” and so on, up to Sunday. As it becomes clear from the narrative, this kind of title is mediated by the “business trip” nature of the main character’s stay in the Such City, counting down the days he spent here. The beginning of the countdown is not from Monday, but from Tuesday, most likely, is explained by the simple fact that the flight of the plane that brought the hero to the Such City took place on Tuesday, and not on Monday. But the laws of the artwork force us to find other explanations. The naming of chapters as “1st day”, “2nd day” and so on involuntarily suggests the days of creation, especially since biblical allusions have already sounded in the title of the novel and, as it becomes clear from the narrative, are provoked by the task of finding the roots of art by the main character. Thus, from the point of view of compositional construction, the whole novel appears as a kind of closed system — the very six divine days of creation that the director needed (such is the professional affiliation of the central character), that is, the creator, to comprehend and feel his own new cinematic idea. “Dropped out” from the calendar list “Monday” in this system is the off-screen (off-story) life of the hero-director. And, probably, the arrival day that happened by chance on Tuesday leads to the fact that the entire former and ordinary (daily and habitual) life of the character is figuratively represented by one big Monday — a “difficult day”, the big and long life that the director lived outside the festive and carnival business trip time allotted to him in the Such City.

The combination of cinema and literature techniques in the novel dominates the text and concerns things not only general, but also private, for example, the location of the hero(s) within the literary text. This spatial territory of the novel is chosen by the Such City, which, as is clear from the narrative, turns out to be Venice — the very name of the city only sounds twice in the text. The substitution in the name of the city, then by the Such City, then by Venice, turns out to be important for the writer. On the one hand, he paints the real Venice, with its canals and squares, reproducing the features of its topography with almost cartographic accuracy, on the other hand, the author creates the image of some mysterious of the City in which extraordinary mystical events take place. The combination of “reality and dreams”, which is mentioned in the annotation, turns out to be one of the end-to-end techniques of Kuritsyn-Turgenev and mediates all layers of his novel narrative.

As for the time depicted in the novel, it also turns out to be concrete and abstract at the same time, accurate and amorphous: Turgenev’s heroes are either in modern Venice, or in a remote time (forward or backward, into the future or into the past) the Such City. That is why the phrase “... well, where am I ... on the Moon” (Turgenev 2008, 7), casually thrown by one of the heroines, does not look unloaded with meaning, but generates either a real or virtual expansion of space, leads to a novel intrigue related to the allegedly planned flight to the Moon. This gossip-rumor also becomes one of the direct engines of the plot, involves novel characters in its orbit (for example, heroes named Borya, Slava, Sasha and even a representative of the Chinese Province of the Blue Goat are going to fly to the Moon).

4.2 The system of the novel’s heroes

The main characters of Kuritsyn-Turgenev’s novel in the annotation are called “bohemians”, more specifically — publishers, magazine editors, artists, graphic artists, installers, almost illusionists. But the main one among them is the “Russian VIP”, a well-known titled director who came to Venice (Such City) to complete his film, which is supposed to be shot here. The hero’s name is Konstantin Nikolaevich. The surname is never pronounced “out loud”, although it sounds “off-screen” in the text when one or another heroine either addresses the hero, or simply calls him by his last name. Moreover, the name of the hero is written out in the text in a peculiar way: only the second half of it, the patronymic, is subjected to a case change. Together they are an indivisible unity. That is, in this case, Kuritsyn is on the verge of combining right and wrong, accurate and erroneous, familiar and peculiar.

Konstantin Nikolaevich is a native of the Urals, who many years ago (forty years ago) created his first and only film (called “The River”), which received the prize of the Venice Film Festival — the Winged Lion. Since then, the director has not created anything else, but now — at the end of his years — he is going to make a film about a vision girl who was once his love or about events that could be connected with her. Even more precisely, many years ago, the director began shooting the second film after “The River” called “The Lake”, but during the filming, the performer of the main role and the beloved of the main character Sonya tragically died. It is to her that the new film by Konstantin Nikolaevich — “The Lagoon” — should be dedicated.

The named series of films of the main character: “The River” — “The Lake” — “The Lagoon” — on the one hand, testifies to a certain mutual dependence of these “water” films, about a certain conditionality of the interests of the main character, about a certain abstraction that the author chooses as one of the narrative principles. But, on the other hand, each of these films is reproduced in detail in the text of the novel, is presented through the consciousness of the filmmaker and is almost stage-reproduced in his memory. Episodes of the future film are reproduced in the mind of the hero-director even in several “working” versions, in different storylines. The principle of combining, originally set, also works here, through the use of a cinematic change of general and close-ups, through a change of general and private, generating the desired volume, a kind of cinematic video sequence.

It is this storyline — the director’s search for the plot of the future film — that most of all provides the overlay of “reality and dreams”, it is on this line that the highest degree of intersection is achieved: until a certain time, the heroine named Sonya forms a kind of stereoscopy of vision, she is equally perceived as a real character, then as a dream-dream of the protagonist. The events taking place in the mind of the hero-director are deliberately recreated by the author with the same degree of accuracy as reality, with an equal measure of verisimilitude and authenticity. Cinema becomes essentially the life of Konstantin Nikolaevich, his life is an important and essential part of cinema. His beloved appears either as the heroine of his story, or as a performer of fictional or real cinematic roles. The bizarre interweaving of cinematic angles of Fellini’s films really find their echoes in the literary text of Kuritsyn-Turgenev.

The postmodern metaphor “life is cinema” finds its realization in the Kuritsyn text. The metaphor comes to life and acquires its metonymic qualities in the novel: then life according to the laws of the part and the whole becomes an integral part of the film reality, then cinema imposes its artistic principles on human (or character) life.

4.3 Main or secondary character

As already mentioned, Konstantin Nikolaevich is brought out in the novel as the main acting character around whom all events are concentrated, in connection with the image of which the time spiral is unwound. The reality of the character’s dominance is supported by the realism of recreating his appearance. Individual features of the main character’s habits and manner of his speech embodiment, some facts of his biography tie him so closely to the everyday life canvas that sometimes the name of a vip-director can be guessed by the name of a real vip-writer (for example, V. Makanin). It is the image of Konstantin Nikolaevich that “gathers” the entire character system around him, it is his event series that essentially exhausts the plot of the novel-cinema. The death of the hero sums up the novel (although in the text there are also “framed” images of old women, intentionally named by the author *parks*, which give the plot the final framing completeness).

Meanwhile, the main acting character Konstantin Nikolaevich cannot be unequivocally recognized as the main character. The fact is that in Kuritsyn’s novel, indeed, “all the Bohemians” are

busy solving “fatal questions” — first of all about the meaning of art, about its forms. For example, it seems that a hero named Borya, who is not very talented and not of the first rank, is always “at the mercy of images” (Turgenev 2008, 10), they “obscure” him the “true essence of phenomena” (Turgenev 2008, 41). Konstantin Nikolaevich is the only one of the heroes who has never asked this or similar questions. The hero-director is not a thinker, he is rather a dreamer. He doesn’t even live in a movie, but only in dreams and memories. The image of Konstantin Nikolaevich was created by Kuritsyn-Turgenev in such a way that the talent and creative giftedness of the hero can only be judged “from other people’s words”. Most often he speaks of himself — “insanely talented” (Turgenev 2008, 29), or: “I am a legendary old man ...” (Turgenev 2008, 171).

Not once does the hero utter a single smart talented idea worthy of his VIP, does not give a single meaningful observation, does not express a single interesting judgment. It seems to be said about the hero-director that “the creator in Konstantin Nikolaevich <woke up> at the crack of a teaspoon” (Turgenev 2008, 34). However, a hero who ascended the cinematic Olympus with a single film and for forty years not only did not create, but also did not try to create something that occupies him, can hardly seriously be called a talented or brilliant person, can hardly take on the role of a leading character (although, it seems, he is exactly that conceived by Kuritsyn). It is no coincidence that one of the people close to him called the hero “behind his back” a loser whom “no one remembers” (Turgenev 2008, 327), which largely follows from the course of events of the entire novel. Even the titular novel formula does not belong to Konstantin Nikolaevich, but is pronounced by another character — a Lord, as it seems, without finding a proper response and understanding in the soul and consciousness of Konstantin Nikolaevich. Ultimately, even the final death of the hero will befall him not in connection with creative pursuits, but in connection with his senile infirmity.

The weakness of the character of the main character is found “between the lines”, is not advertised by the author in any way. But, apparently, not being planned by the writer, the weakness of the conditionally main character is manifested in all his behavior: both in how passive he is in today’s reality, and in how pathetically cowardly he once in the distant past could not protect Sonya from Anna (the scene on the morning lake), how in the plan of the film, he variously sorts out the treacherous departures of the loving Sonya, as he petty rushes between her imaginary lovers. A film that was not created as a result by a “talented” director, as it turns out, could not have been created: it is insignificant and petty in its essence, in its design, it is banal and primitive. It’s not interesting. And the point is not that the plot moves of the planned film are excessively simple, but that a gifted creator-hero should have understood that ingenious simplicity does not consist in reproducing everyday life plausibility, but in comprehending the existential side of human life. Therefore, in the course of the narrative, the hero turns out to be just a “wedding general”, “a historical decoration of the local landscape” (Turgenev 2008, 59).

However, in the novel, which is all permeated with the techniques of substitutions and comparisons, the role of the main character, perhaps, could not be the role of Konstantin Nikolaevich. In the novel-mixing (in the novel-the movie “by Fellini”) it could move, according to the author’s idea, from one character to another. The image of an aging film director (“soon seventy”, Turgenev 2008, 59) connects all the events in the novel, his beloved Sonya allows Kuritsyn to “mix everything” in the Such City (and in such a novel). But the role of the creative leader of the Kuritsyn bohemia, oddly enough, is assumed by the Lord, a character not as handsome as Konstantin Nikolaevich, but clearly gifted and extraordinary. It is to him, ultimately, that the dominant role in the novel belongs. It is he who utters the ideologically sacred novel maxim about the meaning of art — “So that God will tear you to pieces from the inside!” (Turgenev 2008, 104). He also casts a lot of such maxims along the way: “The artist must suffer <...>” (Turgenev

2008, 73), “Art should torment <...>” (Turgenev 2008, 202), etc.

It is curious that in connection with the image of the Lord there is another novel shift. On the one hand, the concrete everyday realities and precise details, subtle and vivid judgments of the Lord give to his image life features, but on the other hand, his “technogenic” imagery clearly turns out to be beyond the realistic narrative, giving rise to another level of combining “reality and dreams”, authentic and fantastic.

The image of the Lord suggests the essence of the novel society. On the one hand, it is realistic, on the other — absolutely absurd and fantastic. The characters are introduced into the text without representation, without stories, without even marking the signs of their professions. Continuing this series, one may ask the question: who are the heroes of the novel by nationality, Russians or Italians, French or Chinese? What language do they speak among themselves?

It is quite obvious that Konstantin Nikolaevich is a Russian vip (as he is called in the novel), the heroes named Sasha and Slava are Ukrainians, the Siamese twins are Chinese. As for the other heroes, it is difficult to say with certainty about them. For example, the Lord, as if, should be Russian. Moreover, prototypical references point to the features of the Russian artist who owned the installation “Into the depths of Russia” (for example, the features of the artist Oleg Kulik) (Turgenev 2008, 167-168). However, nowhere in the novel is the hero’s past mentioned in a word. On the contrary, in conversation with the characters, his “foreignness” is often felt.

The same can be said about the heroine named Cipollino. Who is she? Italian? Chinese? Russian? And the character that the characters in the novel call Mom? It probably doesn’t matter in Kuritsyn’s text. The author does not write a realistic novel, but creates a cosmopolitan gaming reality in which a real human skull decorated with diamonds can be exhibited (or not exhibited) with equal success, corpses of deceased celebrities can be collected, a terracotta boy can be present, as a distant allusion to the terracotta army of the first emperor of China. The boundaries of reality and fiction are shifted and blurred.

That is why the language of the characters in the artificially created reality had to turn out to be a kind of Esperanto, a mixture of “French with Nizhny Novgorod”, reproduced either in the “Russian translation”, then in the original language, then using alliteration, then simply on sound-letter consonances. As indicated in the novel: then “in bad Italian”, then “in bad Russian” (Turgenev 2008, 10).

The names of the heroes are also in the same mixed series. Along with the usual Russian (Slavic) names — Borya, Slava, Sasha, Anna, Sonya, in the novel there are also unlikely names — Vergnitka, as well as nicknames — Salo, Bludo, Lord, Chippolina, Shrek, etc. This fundamentally mixed series of realities, details, images continue the un(in)differentiation of the living and the dead. So, for example, already on the first pages of the novel there is a conversation about a certain boy (Turgenev 2008, 8-9), about whom it becomes clear only later that he is not a living boy, but a terracotta figure at an exhibition of contemporary art. It should be added that in the dialogical speech of the characters, the author includes sounds “inanimate”, “inhuman”, as if recreating the whole cacophony of sounds that surround a person.

4.4 Combining verbal and visual strategies

So, in Andrey Nurgenev’s (Kuritsyn’s) novel “So that God will tear you to pieces from the inside!”, the leading and end-to-end principle of the narrative turns out to be displacement, the principle of “non-differentiation” (according to Fellini), which manifests itself at all levels: place — time — hero. In continuation of the techniques of Fellini’s films, Kuritsyn vividly organizes the appearance of various characters in the artistic space of the novel. Thus, the camera of novel vision

moves from one character to another, while changing time and place, moving from subject to subject without stopping or interrupting the artist's gaze, like the movement of a movie camera. At the same time, the combination of verbal and visual art strategies simultaneously becomes a signal of "stylization" not only for films by Fellini, but also for the art-objects by Moscow conceptualists.

It is clear that Kuritsyn did not seek to consciously imitate the practices of conceptual art, but the very attempt to combine literature and cinematography, the imposition of the principles of various arts, in this case turns out to be conceptualistic in nature. Quite organically in this context, the heroes look like artists, not cinematographers, and as it is clear from the narrative — these are precisely conceptual artists, with their principles of new art. So, during a chess game in the literal sense of the word "eaten rook" (Turgenev 2008, 78) is perceived only as the realization of a metaphor, like, for example, in V. Sorokin's novel "Nastyia". In Sorokin's novel: birthday girl, "newly baked" (Russian phraseology) Nastyia was really baked in the oven (see more about this: Bibergan 2011). The mention of Warhol's name only reinforces this association (Turgenev 2008, 201).

Combining the techniques of cinematic vision within a literary text suggests a comparison of Kuritsyn's prose with V. Pelevin's texts. In this case, we can recall Pelevin's novels, which are stylistically related to Kuritsyn and incorporate multiple film plans. Among the possible stylizations "under Pelevin" can be called the pretextual novel "The Prince of Gosplan", in which the novelist combines computer and everyday realities, virtual and usual (for more details, see: Leiderman 2003, Bogdanova 2019).

The principle of stylization can also include such passages of Kuritsyn, which can be qualified as "Tolstoy" — from Tatiana Tolstaya. The feminine beauty and metaphorical nature of Tolstaya's phrase finds its echo in Kuritsyn-Turgenev's prose — his tables with cups of vergnitka's coffee are generated by associations not only to Fellini, but also to Tatiana Tolstaya with her cubes, circles, triangles and trapezoids of saucers, cups, sliced sausage or pieces of cheese (for example, in her story "Honey Shura") (Leiderman 2003, Averyanova 2012, Bogdanova 2019).

A certain share of the originality of Kuritsyn-Turgenev's prose is the language, philological command of speech, the author's ability to use tones and semitones of individual phrases and words. The accuracy of observations, the beauty of comparative series, the abundance of comparisons and metaphors are perceived by the characterological dominant of the writer's artistic manner. Kuritsyn accurately and delicately knows how to use a word, skillfully betraying the common name of his own name, or vice versa, bringing identity in the naming of non-individualized and non-personalized object. So, the name Pablo sounds brilliantly and wittily in his novel, conveyed as if by personal writing, but addressed to faceless and monotonous characters, similar to the smallest detail in the form of clothing, behavior and facial expression. In whatever cafe, restaurant, bar the characters turn out to be, next to them are indistinguishable in appearance characters-waiters named Pablo.

The multiplicity of literary references in Kuritsyn's text is attractive, their recognizability is smart and fun at the same time. In Kuritsyn's novel, allusions and receptions are subtracted from Kant, Collins, Aksenov, Bitov, Sorokin, Pelevin, Tolstaya, even Gorky or Astafyev. The reader meets with the writer's ability to hear sounds, to paint them: his hero can trust "dragonfly and arrow" (Turgenev 2008, 18), etc. However, more than in any of the previous novels, in this novel Kuritsyn-Turgenev often makes such polysyllabic comparisons ("untimely associations", Turgenev 2008, 19) that they do not always lend themselves to imaginative awareness. So, to determine the color of "burnt lentils" (Turgenev 2008, 43), it is unlikely that any of the readers will succeed today. In the expression that the jelly resembles "the skin of an aging fat woman" (Turgenev 2008, 138), there seems to be a lot of incorrect.

The lack of restraint of the speech tonality of individual characters of Kuritsyn again (as in previous novels) makes itself felt. So, a heroine named Anna in one scene is amazed by the speech of a certain beauty, who, in response to a phone call, suddenly begins to say "like a market girl, or something" (Turgenev 2008, 70). But already in the next paragraph, she herself uses the word "break off" (Russian vulgarism) or calls her aged ex-lover a "bald-headed bouncer" (Turgenev 2008, 71), although in the vocabulary of an Italian countess who has lived in her second homeland for almost 20 years and is divorced from street Russian speech, this is hardly possible and motivated.

A certain flair of provinciality is felt on the pages of Kuritsyn's novel. It would be one thing if a writer allowed his characters to use extra-literary forms of the Russian literary language, allowed errors in their individualized speech, but the fact is that incorrect pronouncing norms are often present both in the speech of his characters and in the neutral speech of the author. However, even a game novel (and maybe a game novel in the first place) should not have allowed this. All non-artistic trifles could be easily eliminated with the most superficial editorial editing. But Kuritsyn focused on playing with the word of the Moscow conceptualists D. Prigov, L. Rubinstein, V. Sorokin (see more about this: Bobrinskaya 2006, Bibergan 2011, Bogdanova 2023), that is, he wanted to combine the "low" art of modern Russian postmodernism with the elite art of Fellini. But one can hardly imagine that Fellini could afford non-creative errors, which are alien to him, but for Moscow conceptualists they are principled and manifestational. Unfortunately, Kuritsyn-Turgenev did not take into account not only the difference in art, but also the difference in style.

5 Conclusion

Concluding the conversation about Kuritsyn-Turgenev's novel "So that God will tear you to pieces from the inside!", it is necessary, firstly, to return to the writer's pseudonym chosen by the critic and doubt its relevance. The precedent name of Ivan Turgenev, which is involuntarily actualized in a modern pseudonym, is used by the critic-writer, in our opinion, groundlessly and uncreatively. Secondly, given the mighty tradition of Russian literature, we would like to keep the faith that there will come a moment for modern Russian art when (as one of the heroes of Kuritsyn's novel promises) "low" will be returned "its revealing scale" (Turgenev 2008, 54), when the "empty sign" will not be issued "for a sign with a meaning" (Turgenev 2008, 294) and when "you figure out about everyone" — "does an aesthetic act exist or has he simply gone crazy" (Turgenev 2008, 230). It remains to be hoped that the literary experiments of Vyacheslav Kuritsyn (Turgenev? Sirin?) will not become literary "nonsense".

6 Prospects for further research

Concluding the analysis of Kuritsyn's mixed texts, we can say that (in the main) his practices contained the foundations of the theoretical base of the "Moscow conceptualism". The novelist made an attempt to imitate the techniques of conceptual writing, appealing not to painting and literature, like I. Kabakov, E. Bulatov, V. Pivovarov, D. Prigov, but to cinema (Fellini) and literature, mixing strategies of different arts. Further study of Vyacheslav Kuritsyn's texts will allow us to discover new components of his conceptually imitative creativity and better understand the principles that the followers of Moscow conceptualism are trying to reproduce.

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EXPERT WITNESS LIABILITY

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Abstract: Currently, a number of experts in the Czech Republic and Slovakia are ceasing their activities. For many of them, the reason is mandatory examinations; in some other cases, it is, for example, the unclear liability of the expert witness along with large penalties for violation of given rules. The purpose of the paper is to define the fundamental parameters of expert witness liability in the Czech Republic and Slovakia in the light of the global trends in the field. The primary method to achieve this goal was content analysis. The data source used was legal documents, as well as opinions published in scholarly and expert publications. The liability of expert witnesses lies not only in the compliance with the set rules and standards but also in the ability to adapt to new challenges and ensure that their work is as relevant and accurate as possible. Expert witnesses thus bear liability at multiple levels, including ethics, professional standards, legal obligations, and practical considerations. Nevertheless, there is no established judicial practice in this area in the Czech Republic and Slovakia.

Keywords: expert witness, public authority, liability, expert law.

1 Introduction

At the time of a common state of Czechia and Slovakia, expert activities were governed by Act No. 36/1967 Coll., on Experts and Interpreters, as amended.

The Slovak Republic adopted a separate regulation on 26 May 2004. Specifically, it was Act No. 382/2004 Coll., on Experts, Interpreters and Translators and on Amendments and Additions to some other Acts, which is still in force. The Act has been amended more than ten times (including indirect amendments) and is still in force today.

The Czech Republic adopted a separate regulation many years later, specifically on 10 September 2019, and this Act No. 254/2019 Coll., on Experts, Expert Offices and Expert Institutes has not been amended so far. However, the Ministry of Justice of the Czech Republic is currently preparing a so-called technical amendment to the Act, which is supposed to resolve some technical problems of the current legislation in force (as a result of which the number of experts in the Czech Republic has decreased significantly), the problem of expert opinion registration, etc.

The 1967 regulation on expert witness activities defined expert witnesses primarily as experts in their field. At the same time, it established a basic range of procedural duties and a minimum amount of knowledge of law. From the perspective of the exercise of expert activities, experts were thus amateurs. Nevertheless, both the current Czech and Slovak legislation significantly changes this view of expert activities. Expert witnesses are not only perceived as experts in the field in which they work (economists, engineers, builders, etc.), but also professional experts. They must have sufficient knowledge of law, must be experts in methodology, be psychologists, and have adequate communication skills. Therefore, for registration as an expert, both legal regulations require legal capacity, personal and professional integrity, initial training (hence minimal professional qualification for performing expert activities), professional examination, etc. This way the applicants for registration on the list of experts prove their competence (both knowledge and skills). The legislation of both states thus specifies who is an expert and what they must know, and deals with the performance of expert activities, including experts' rights and duties, which are very much related to the liability of expert witnesses.

The liability of expert witnesses is addressed very briefly in both legal regulations. In Slovakia, the Act on Experts mentions liability for selected expert acts or for failure to fulfil obligations in several provisions of the Act. In addition, it ties the liability of the expert to the obligation to insure for damage arising from the performance of expert activities. The Czech legislation addresses

liability in a separate section of the Act on Experts, namely the provision of Section 21 Liability for the performance of expert activities. The provision includes two paragraphs: the first paragraph states that the expert is obliged to compensate for the damage they have caused in connection with the performance of expert activities; according to the second paragraph, the expert may be exempted from liability if they prove that the damage could not have been prevented and that the expert had made all the efforts that could be required to prevent such damage. The Czech Act on Experts also links liability to the performance of expert activities and to breaches arising from the established rights and duties of the expert. At present, experts are obliged to take out an insurance policy against damage relating to the performance of the expert activities. Both Czech and Slovak legislation consider the breach of the obligation to insure to be a completely unprecedented offence. However, an amendment to the Czech Act on Experts envisages the abolition of the obligation of experts to take out insurance. There are several reasons: firstly, in some fields of expertise, expert opinions are very rarely required; secondly, there are exceptions for contracts where, in fact, the damage caused by the expert is not covered by insurance.

This makes the issue of liability for damages even more pressing. Liability has been adjudicated many times in the past. In particular, in the Czech Republic, there is a body of case law relating to liability for the performance of expert activities established before the new legislation was introduced.

Expert activity is undergoing a continuous development. In the Czech Republic, legal practice has not been established yet; similarly, in Slovakia, liability for the performance of expert activities is still relevant.

Expertise extends to private law (civil law) and public law (criminal law and administrative law). The damage caused by the performance of expert activities thus always plays a role.

The objective of the paper is to assess the basic parameters of the liability of expert witnesses in the light of the legal system of the Czech Republic and Slovakia.

2 Materials and Methods

When considering *de lege ferenda*, it will be necessary to review not only the relevant Czech and Slovak literature, but it will be interesting to see how the issue is addressed in developed countries around the globe and where it is headed ideologically. Thus the source of data would mainly be Web of Science or Scopus indexed journals.

The method of data collection will be content analysis. The general source of data will be the witness expert laws of both countries, namely 254/2019 Coll. in the Czech Republic, and 382/2004 Coll. in the Slovak Republic, their implementing decrees and related laws. Furthermore, it will be necessary to take into account the global trends in witness expert liability presented by scientific and professional journals. For the processing of data, the following formal logic tools will be used: analysis, synthesis, generalisation, deduction, abduction, deduction, comparison, or scientific observation, etc.

3 Results

3.1 Main trends in expert witness liability

The duties of an expert witness are crucial when it comes to providing evidence in court cases/trials. Expert witnesses play an important role in helping the court understand complex technical issues and they provide insights based on their knowledge and experience. It is essential that experts are impartial, objective and provide accurate evidence to support their opinions. If called upon to provide expert evidence, a witness expert will need to perform their role with transparency, professionalism and

integrity to achieve the best outcome for all parties involved (Rochester, 2001). The expert witness is required to produce the expert report by himself. Breach of the duty to produce an expert report on one's own responsibility may result in loss of entitlement to remuneration. The commissioning court and the (potential) expert are therefore advised to disclose foreseeable difficulties with regard to qualifications, time of submission or content of the order openly and in a timely manner. This allows the court to either modify or clarify the competencies of the witness expert or to select another expert if necessary; the expert will avoid any misunderstanding or conflicts (Lesting, 2021). This alone refers to the responsibility of each individual expert witness. A witness expert should carefully evaluate whether he or she has sufficient capacity in terms of time, expertise, and physical strength to properly give an expert opinion. And if the expert witness concludes that they have insufficient capacity to provide an expert opinion, the expert should responsibly communicate this fact to their client. This is because open and transparent communication about any limitations or difficulties allows for timely resolution and minimises potential problems throughout the process.

As regards the strict liability of the expert witness, a distinction must be made between liability under civil law and criminal law. Liability in criminal law means punishment for culpable and unlawful committing a criminal offence in the legal sense; liability in civil law means compensation to another citizen. Criminal prosecutions are conducted *ex officio*. A prerequisite for criminal prosecution in civil law is the victim's conduct (Jansen, 1996).

It is therefore clear that expert witnesses can play an important role in assisting the court in civil and criminal cases. When they are called, their testimony is relied upon to help identify disputed facts to the extent that the parties are in dispute. Thus, the court must believe that the expert has been properly instructed and that he or she is aware of his or her responsibility to act with no bias (Rochester, n.d.). Further, expert witnesses have a duty to keep up to date in their specific field of expertise (The Role & Responsibilities of an Expert Witness, by Fiona Brassil, n.d.).

According to "No Two Sides in Forensic Science | TFEG Singapore" (2018), expert witnesses actually have the privilege, albeit a significant responsibility, to produce expert reports in their field of expertise to assist in legal proceedings. Unlike the prosecutor and defense counsel in adversarial proceedings, each of whom supports a particular position, forensic science does not have an advocacy role. Simply put, there are no parties in forensic science. It does not matter which party engages a forensic expert; it only matters whether the expertise of the forensic expert can assist in the search for truth. Wahlberg & Dahlman (2021) mapped the extent of epistemic authority of expert witnesses to interpret and explain evidence and uncertainties that fall within their expertise. They argue that expert witnesses should only testify on questions of fact and should not opine on questions of law and other ultimate judicial questions, such as the likelihood of a hypothesis given the evidence. Rather than that, expert witnesses should facilitate the decision-maker's assessment of how strongly the evidence supports the underlying hypothesis given all the uncertainties involved.

This suggests that expert witnesses should be cautious in providing their expertise, focusing on factual issues and leaving the legal assessment to the decision-makers, which is essential to the expert witness's liability and their role in the judicial system. It is also related to this that one of the greatest tragedies in the criminal justice system is to convict a person for a crime that they did not commit. Wrongful convictions can have immeasurable consequences for exonerees, original victims of crime and their families. In addition, they can also have long-term negative effects on witnesses, investigators, lawyers, judges, and other criminal justice professionals involved in wrongful convictions (LaPorte, 2017).

Expert witnesses are nowadays common members of criminal and civil trials. The use of experts and the admissibility of their

scientific knowledge has changed over the last 250 years, with the concept of allowing an expert to give an opinion on the facts of other witnesses being allowed by Lord Mansfield in *Folkes vs Chadd* in 1782 (Milroy, 2017). National legal statutes set out the duties and responsibilities of expert witnesses and their right to conduct expert evidence. Most countries have defined requirements (education, training and/or certification) for recognition as a expert witness and for conducting forensic examinations in a particular field (European E-Justice Portal - Forensic Experts, 2021).

The issue of the expert witness's liability is also related to the definition of the judge position and the expert position in judicial decision making. In the 19th century, the practice was that an expert witness could not be held liable for errors in their opinion if their conclusions were accepted by a judgment: this would challenge the authority of *res iudicata*. Now case law recognises the preponderant position of an expert witness in assessing technical issues beyond the knowledge of the judge. The expert must observe the guiding principles of judicial procedure. Their liability is engaged for many reasons: the discipline specific to forensic expertise and the ordinary discipline sometimes overlap, the criminal liability under common law for breach of professional secrecy, and finally the civil liability under common law which imposes financial responsibility for their harmful actions (Gramond, 2020). This was followed up by David & Lewis (2018) who argue that future liability relating to expert witness testimony in criminal or civil cases was rarely considered in recent years. However, this situation has changed considerably in the 21st century. While some immunity may exist when expert witnesses testify on behalf of a government agency, it is often limited or nonexistent. Moreover, no such protection exists in civil cases. It is important that experts be aware of what they can do to protect themselves from potential legal action as a result of their testimony. According to Cappellino (2021), immunity for expert witnesses has always existed in the United States legal system as the doctrine originated in 16th century Old English common law. The doctrine of immunity for testimony (also referred to as privilege) is a common law doctrine that protects witnesses who testify in court proceedings from legal actions arising out of their testimony. The public policy rationale for this doctrine is that witnesses should feel that they can testify the truth without fear or intimidation that a retaliatory civil action would be brought against them. The U.S. Supreme Court reiterated the importance of witness immunity in *Briscoe vs. LaHue*, 460 U.S. 325 (1983), which held that all witnesses, including law enforcement officers, are absolutely immune from civil liability for perjured testimony given in court. In the *Briscoe* case, a convicted man brought an action against police officers who gave perjured testimony in a criminal trial that led to the plaintiff's conviction. The court ruled that the officers were immune from civil liability, noting that the possibility of a threatened trial could invalidate the testimony. However, some countries and courts began to criticize some aspects of this immunity. Courts have begun to recognize that expert witnesses may be liable if they are negligent in their professional duties. This is partly due to the boom in the use of expert witnesses over the past thirty years and the expansion in the areas of professional and scientific research. Binder (2002) explained the traditional concept of expert witness's immunity and showed how a number of factors have caused that this immunity weakened. These factors included the increase in the number of expert witnesses, the inadequacy of traditional safeguards against potential prosecution for perjury and cross-examination, a higher degree of attorney misconduct, the lack of protection for the injured party against unscrupulous witnesses, and the ineffectiveness of the judgement in *Daubert vs. Merrell Dow Pharmaceuticals*.

The above studies clearly show that the liability of expert witnesses is increasing, mainly due to changes in the legal context and attitudes towards their role. The evolution of the perception of liability from the historical exemption from errors in judgment to the current emphasis on the predominant role of the expert witness in reviewing professional issues suggests a continuing development in forensic expertise.

In 2011, the UK Supreme Court abolished the immunity of expert witnesses from prosecution for misconduct. Cerchia (2013) discussed whether similar changes would lead to similar results in Italy. In the Italian system, they may be liable, but in practice expert witnesses have a kind of informal 'immunity' protecting them from actions for damages. The discrepancy between the theoretical law and the practical position can be explained by the fact that expert witnesses in fact enjoy some protection from lawsuits under the Italian legal system.

In providing expert testimony in asylum proceedings for mentally ill Mexicans, Duncan & Reyes-Foster (2022) were regularly asked to reduce individual subjects to diagnostic categories and the entire country to one of its worst performing institutions. Attorneys and judges were asked how does Mexican "culture" - through its institutions and mental hospitals - treat the mentally ill? There must be a clear and often single "truth" for judges deciding asylum claims. However, as Nikolas Rose argued, "truth is always embedded in acts of violence". The authors therefore addressed an issue inherent in this work: to whom - and to what truths - are anthropological expert witnesses accountable? Although the aforementioned work was focused on anthropological expert witnesses, it is necessary to address others as well, and this is because this particular topic is important in other fields as well.

According to Paineau et al. (2020), the dual role of a forensic medical examiner entails several professional duties and responsibilities that are crucial to justice. Reflection on the ethical aspects of this function reveals that regulations and jurisprudence often do not define all that is essential for this function. The forensic medical examiner delegates extensive responsibilities to medical professionals although they interact with the justice system. They are held accountable for any errors in their medical and expert work in terms of civil, criminal and disciplinary law both under the control of the judicial system and their peers. They also pointed to the ambiguity of the status of a forensic medical expert who despite the importance of their role may not be officially recognized as a regulated legal profession. This merge of the medical sphere with the judicial system creates a challenging position where one must not only meet ethical requirements but also deal with the legal and professional challenges associated with this multifunctional role.

Another specific example can be applied to an expert witness in a forensic engineering project. By agreeing to be an expert witness in a forensic engineering project, the engineer inherently takes on a special responsibility. As a rule, these responsibilities can be defined through the ASCE Code of Ethics. The health, safety, and the public welfare are paramount among the canons of the Code of Ethics. This means not becoming an advocate for your client, but being an advocate for the public welfare. In some cases, an expert may feel a conflict with the need to criticize the work of other engineers. How the expert must handle this situation will be dictated by consideration of the canons of the Code of Ethics (Nelson et al. 2022).

In general, all 3 previous articles highlight the importance of ethics in the work of expert witnesses and discuss the challenges associated with the ambiguity or lack of definition of some aspects of their role. They further agree on the very complex ethical and professional liability.

These factors can also result in a miscarriage of justice, which can arise as a result of misinterpretation of expert reports, inadequate communication between experts and the court, or inaccurate evaluation of evidence. According to Kennedy et al. (2020), the Forensic Science Regulator was formed in 2008 following a series of high-profile miscarriages of justice in the UK associated with questionable expert evidence. The main objective of this role was to improve the level of competence of experts and forensic practices. At present, there is no statutory requirement for practitioners to gain accreditation to continue working for the criminal justice system in England and Wales. However, the Forensic Science Regulator is lobbying the UK Government to make this mandatory. Therefore, the authors focused on the challenge of incorporating scientific methodology

into digital forensic investigations where malicious software ('malware') has been identified. Based on the literature, legal, regulatory and practical needs, they defined a set of requirements to address this issue. They presented a framework called the "Malware Analysis Tool Evaluation Framework" (MATEF) that addresses this lack of methodology for evaluating software tools used to perform dynamic malware analysis during investigations involving malware and discusses how it meets the defined requirements. As a whole, this article can impact the accountability of forensic examiners by emphasizing improved standards, requiring accreditation, and promoting a scientific approach to digital forensic investigations through new methodologies and tools.

The question is what can be the impact the liability of expert witnesses. Craig (2021) looked at the impact of the new rules of court procedure introduced in England and Wales in January 2013 on expert witness psychologists (EWPsychs). In order to identify the current issues facing EWPsychs, a mixed methods approach was used which involved a questionnaire survey of 58 psychological experts and qualitative data analysis. Several key topics emerged from the results, including training and knowledge, changes to the Legal Aid Bureau's court rules and fees, quality of reports, pressure to change opinions, conflicts among EWPsychs, and feedback from expert witnesses. A significant number of psychologists working as expert witnesses did not take any specific training to become expert witnesses, and some reported that limited legal aid fees had influenced their decision to become expert witnesses. Respondents also expressed the view that legal aid rates do not adequately reflect the value of their work. This suggests that the liability of expert witnesses may be influenced by their remuneration. Indeed, if expert witnesses feel unhappy that their remuneration for legal aid does not reflect the value of their work, this may affect their motivation to provide high quality and carefully produced expert reports. Financial pressure may cause them to try to speed up the process or provide inadequate expert evidence, which could have an adverse effect on the overall quality of their work and their accountability in the lawsuit.

Perisa & Arbanas (2023) studied the issues of inconclusive or missing information in forensic psychiatric evaluations and highlighted the possibility of supplementing evaluations when new information is available. A study conducted at the Vrapka University Psychiatric Hospital analyzed 42 cases of supplementary evaluations to identify factors associated with changes in these evaluations. Findings showed that changes were more common in those diagnosed with a personality disorder (PD) only compared to those with comorbidities, particularly substance use disorders. Defendants diagnosed with a substance use disorder were 63.7% less likely to have their assessment changed. The study also reported that the evaluation remained unchanged when new information was caused by the testimony of new witnesses. It concluded that judges should be more critical of requests for supplementing reports in light of the principle of judicial economy. This may again imply that emphasizing a more critical approach by the judge when requesting a supporting report promotes the responsibility of expert witnesses to provide their reports in a manner that minimizes the need for follow-up and is consistent with the principle of economy in the legal system.

Concerned about the distortion of evidence that arises from the strong incentive of litigants to misrepresent information provided to fact-finders, legal scholars and commentators have long suggested that courts appoint their own litigation-neutral advisors. Accordingly, the issue of litigants losing the incentive to provide information when judges seek advice from court-appointed experts has been examined. The assignment of witness experts was found to involve a trade-off: although these experts in general help judges obtain more information, thereby reducing errors during trials, they weaken litigants' incentives to provide expert information, thereby undermining the adversarial nature of the current American legal system (Kim & Koh, 2020). Thus, any shifts in the course of litigation, particularly with respect to the motivation of parties and the role of expert witnesses, may

impact the liability of these experts in the performance of their duties. The credibility of a court-appointed witness expert is a critical factor affecting their ability to implement the duties in a trial. Ferreira & Wingrove (2023) experimentally tested jurors' claims that their perceptions of an expert's credibility are independently influenced by the expert's training and experience, with expert experience having a greater influence. Previously, only the combined influence of these variables was studied. Mock jurors (N = 553) read a trial summary containing testimony from an expert witness with high or low training and high or low experience. They then rendered a judgement and rated the credibility of the expert. The results primarily showed that training and experience independently influenced expert credibility although the latter had only a slightly greater effect.

Now let's see a more specific example. A recent decision in the United Kingdom in a clinical negligence case has clearly indicated that an expert witness must be independent and that caution should be exercised in taking instructions from a solicitor when asked to produce a report in a litigation, particularly if, as a potential expert witness, you have any relationship or acquaintance with the parties. In *EXP-V-Barker* (2017 EWCA CIV 63), the UK Court of Appeal held that an expert witness (a consultant neuroradiologist) who worked with the defendant and co-authored research papers with the defendant, also a neuroradiologist, was too closely connected with him to perform his duty as an expert in giving independent and objective evidence (The Role & Responsibilities of an Expert Witness, by Fiona Brassil, n.d.). Communication in the judicial context, including the use of counterfactual ideas, affects the evaluation of lay jurors and judges, and it may also affect their perception of the credibility of expert witnesses. Indeed, experts are often dependent on how they are perceived in the courtroom. This is demonstrated by Catellani et al. (2021) who studied the influence of counterfactual ideas on attributions of cause and responsibility in a judicial setting. In two studies, participants, including lay jurors and judges, were asked to read a medical malpractice case with counterfactual content. The results indicated that the use of counterfactual ideas had a strong influence on the evaluation of both groups. This communication also mitigated the effect of outcome predictability on attributions of responsibility. The study highlighted how counterfactual communication can shape decision making in a judicial context and suggested possible implications for training programs and interventions for judges.

In terms of discussing specific types of liability, according to Ryskamp (2022), expert witnesses can face liability from many sources at present. These include disciplinary actions by professional associations, sanctions imposed by national and other licensing boards, or civil actions. Not all forms of liability apply in all cases. The approach is rather tailored to the type and extent of the alleged misconduct of an expert witness.

All the above shows that the liability of expert witnesses not only lies in adherence to rules and standards, but also in the ability to adapt to new challenges to ensure that their work is as relevant and accurate as possible. Thus, expert witnesses have responsibilities at several levels, including ethics, professional standards, legal obligations and practical considerations.

3.2 Basic establishment of expert witness liability in the Czech Republic and Slovakia

The Czech regulation, i.e., Act No. 254/2019 Coll., addresses the duties of experts especially in the following provisions:

- § 1 General provisions on the execution of expert activities: the provision stipulates the basic principles of the performance of expert activities.
- § 11 Authorization to perform expert activities: the provision stipulates the obligation of the expert to notify the facts that are a condition for the performance of expert activities within a specified period.
- § 13 Suspension of authorization to perform expert activities: Paragraph 4 deals with the obligation to

complete the work in progress in the event of suspension of expert activities authorization. The only exception are expert opinions whose completion is contrary to the reason for the suspension of the expert activities.

- § 16 Data recorded in the list of experts: the expert is obliged to notify and document changes in the data in the list of experts, if any, within a specified period.
- § 18 Exclusion of expert: experts shall not perform any act in the event they are biased. In the event of potential bias, the expert shall only notify the contracting authority. The decision on the bias is a responsibility of the public authority.
- § 19 Refusal to perform expert activities: the provision specifies the conditions under which an expert must refuse to perform expert activities.
- § 20 Confidentiality: experts are obliged to maintain confidentiality of facts of which they have learned in connection with the performance of expert activities.
- § 22 Insurance of experts: experts are obliged to take out insurance in case they cause damage in connection with the performance of expert activities. Also, they are obliged to notify the Ministry about the conclusion, changes, and termination of the insurance.
- § 24 Notification obligation: experts are obliged to notify of facts that might lead to the suspension or termination of authorization to perform expert activities.
- § 25 Estimated costs: upon the request of the public authority, experts are obliged to make a preliminary estimate of the amount of the expert fee.
- § 27 Expert report: the provision deals with the obligation of experts to prepare a copy of the report for archiving and to archive such a report.
- § 28 Particulars of expert report: the provision deals with the obligation of experts to certify the expert report.
- § 29 Records of expert reports: to the extent prescribed by law, experts are obliged to keep record of information on all expert reports commissioned to them.
- § 31 Remuneration. Experts are obliged to specify in the report whether a contractual remuneration for the performance of expert activities has been agreed.
- § 32 Reimbursement of expenses and compensation for loss of time, including travel time: the provision specifies the obligation to pay value added tax.
- § 34 Billing and payment: experts are obliged to bill the expert fees at the same time as the expert report is submitted.

Section 14 Cancellation of the authorisation to practice as an expert witness in the provisions of paragraph (e)(1) stipulates that the Ministry (of Justice) would cancel the authorisation to practice as an expert witness if the expert has seriously or repeatedly violated the obligations set out in the Act on Experts. This makes the expert liable for the breach of the obligations arising from the Act on Experts. However, a special category is the expert's liability for the performance of judicial expert activity. This liability is explicitly attributed to the expert in Section 21 Liability for the performance of judicial expert activity.

In connection with the expert's liability, the provisions of Section 39, Section 40, Section 41 Offences and Section 42 Common Provisions on Offences need to be discussed at least to a certain extent. The provisions categorise the breach of the obligations arising from the Act on Experts according to their impact and social seriousness of the offence. Consequently, it determines penalties for each breach.

In addition to the above, the Act also deals with the obligations of natural and legal persons before their registration in the register of experts and after their removal.

The provisions of the Act will apply *mutatis mutandis* to expert institutes and consultants.

The Slovak Act on Experts, i.e. Act 382/2004 Coll., as amended, sets out the requirements for expert witness activity in the following provisions:

- § 2 General provisions: the expert must proceed in accordance with the generally binding and applicable regulations. The expert must provide assistance to the court or any other public authority.
- § 4 Register of experts, interpreters and translators: the expert must notify and prove to the Ministry (of Justice) any changes from the data entered in the register.
- § 7a Temporary suspension of judicial expert activity: the expert must inform the contracting authority of temporary suspension of the expert's activity, and subsequently return all documents for the expert's report and advance payments for the expert's fee.
- § 7b Suspension of judicial expert activity: the expert must inform the contracting authority of temporary suspension of the expert's activity, and subsequently return all documents for the expert's report and advance payments for the expert's fee.
- § 9 Requirements for commencement of judicial expert activity: the expert must provide the Ministry (of Justice) with proof of liability insurance for damage caused by the performance of judicial expert activity in the specified amount. Paragraph 1 stipulates that an expert witness can only perform expert activity if they have taken out liability insurance for damage that may arise in connection with their expert activity.
- § 10 Identification marks: the expert must notify the Ministry in case of the loss or theft of identification marks.
- § 11 Exclusion of an expert, interpreter or applicant: the expert witness must notify the contracting authority of any bias or other facts for which they cannot provide the expert service.
- § 12 Refusal to perform: the expert must refuse to provide the expert service in the specified cases.
- § 13 Duty of confidentiality: the expert must maintain the confidentiality of any facts that they may become aware in connection with the judicial expert activity.
- § 14 Logbook: the expert must keep a logbook of their judicial expert activity in electronic form.
- § 14 Expertise: the provision defines the general principles of the judicial expert activity.
- § 17 Expert reports / opinions: the provision defines the obligations to provide accurate expert reports in terms of methodology and facts with the correct structure. And it specifies other requirements for an expert report / opinion.
- § 30 (heading deleted): the expert must take training courses and increase their qualification to the extent specified by the Ministry and participate in professional competence testing.
- § 34 Temporary provisions: it describes the obligations of experts appointed under the previous legislation.

Penalties for non-compliance are set out in Section 26 Other Administrative Offences.

In addition to the above, the Act also describes the obligations of natural and legal persons before their registration in the register of judicial experts and after their removal.

The provisions of the Act will apply *mutatis mutandis* to expert institutes.

4 Discussion and Conclusions

The aim of this paper was to review the general parameters of the expert witness liability in the light of the legal systems of the Czech Republic and the Slovak Republic.

The paper focuses on judicial expert activity. However, it is apparent that expert witness law overlaps several fields of law where one cannot be separated from the other. Expert law is rather marginal in the current educational system both in the Czech Republic and the Slovak Republic. At law schools, expert

law is mentioned rather in the context of some lectures on selected subjects, most often in the field of criminal law.

However, expert witness law is a complex organism that should be understood as a whole, albeit spanning several fields of law.

As far as the liability of expert witnesses is concerned, the legislation, although based on common sources of law, is different in the two countries.

The Czech legislation endeavours to unambiguously define the liability of expert witnesses for judicial expert activity and liability for damage arising therefrom. The Slovak legislation envisages that the expert is insured and damage that may be inadvertently caused by the expert is covered by such liability insurance.

However, different basis can be used to write the paper. First of all, both legal systems assume that damage from judicial expert activity may be incurred by the party requesting an expert opinion / report, or by a third party, and above all by the state due to the failure to perform the duties imposed on expert witnesses by law.

Furthermore, it is indisputable that damage that may be incurred may be social, not defined in financial terms. However, it can also be a large amount. This makes it clear that damage can be both financial and non-financial. It can be financially insignificant as well as it can be financially significant.

Both legal regulations assume that the expert witness will be insured against damage, and such damage will be remediated by the insurance policy. However, the Czech legislation further defines liability for damages in a separate provision of the Act on Experts, namely Section 21 which has two paragraphs. The current insurance practice contains exemptions from claims that makes the insurance meaningless. On the contrary, the Slovak legislation assumes that the insurance will cover any unintentional damage caused by the expert witness in expert evidence and in the development of an expert's report.

In both jurisdictions, deliberately erroneous or incorrect testimony is presumed to be a criminal offence, similar to perjury. In such case, however, the expert witness is held fully liable.

The Czech legislation considers the liberalisation grounds. If the expert witness has made all the efforts to prevent damage, they will be released from liability for any damage caused. The Slovak legislation on judicial experts does not explicitly reflect on liberalisation grounds. However, they can possibly be deduced from the provisions of other legislation.

As a result, both countries are still uncertain about for what and to what extent the expert witnesses in both countries are held liable. Not only is the interpretation of the Act on Judicial Experts vague in both countries, but legal practice has not been established so far.

The contribution of the paper is primarily seen in the definition of the present state and possible direction how to solve a very complex issue, which hampers now the work of experts and public authorities. The number of expert witnesses has been decreasing in the long term, their task is to convey a complex problem in a comprehensible form to facilitate the decision in a case.

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Primary Paper Section: A

Secondary Paper Section: AG

OVERCONFIDENCE, REPRESENTATIVENESS AND HERDING BIAS AMONG GERMAN INVESTORS: HOW DEMOGRAPHIC AND OTHER VARIABLES INFLUENCE THEIR DECISION

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Abstract: The study assesses based on the responses from the survey of 342 persons how behavioural biases affect German investors' investment decisions. Three behavioural biases were examined: overconfidence, representativeness, and herding behavior. It was determined that demographic factors affecting German investors, such as gender, age, experience, education, and frequency of investment, influence this choice. Male German investors are more susceptible to all three biases than females. Young investors (<35 years) are more at risk for the overconfidence bias and the representativeness bias, while older investors (>35 years) are more at risk for the herding bias. Investors with a lower experience (<5 years) on the stock market have a higher tendency for the three biases than German investors with a higher experience (> five years). Investors with a high (i.e. university) education are more susceptible to the three biases than those with a low education. Investors with a high investing frequency (> three months) scored higher for all three biases than investors with a low investing frequency (<3 months).

Keywords: behavioural economics, behavioural finance, behavioural biases, overconfidence bias, representativeness bias, herding bias

1 Introduction

Behavioural biases are among the most common topics in behavioural finance (Baddeley, 2019). As they frequently result in decisions that do not maximize investment returns (Shukla et al., 2020). When an investor makes investment decisions, behavioural biases are psychological abnormalities they are prone to, resulting in illogical choices and an inability to meet investment objectives (Gupta and Shrivastava, 2021). Kapoor and Prosad (2017) referred to these behavioural biases as the cause of investors' irrational conduct in investment decisions impeding the growth viewpoint and defined them as instruments to analyze the anomalies from the economic fundamentals of rationality while making an investment decision.

Even in current times, it has been shown that it is crucial to comprehend how these behavioural biases affect investors' psychological well-being. By overcoming and avoiding the ensuing mistake of judgment, focusing on these behavioural biases will help individual investors improve their performance (Shabarisha, 2015; Sahi, 2012). Investors who focus more on a few investment options and prefer to disregard everything else owing to internal biases have become increasingly prevalent (Gupta and Shrivastava, 2021). Understanding these investors' motivations is crucial today more than ever because the number of investors is increasing and they can create unforeseen momentum in the stock market (Wood and Zaichkowsky, 2004). Most investors purchase high speculative investments and sell low on panic-related feelings. According to psychological research, the delight of making money is three times lower than the anguish of losing money through investments (Pashtoon, 2016). To grasp the core of behavioural finance, a wise investor must reflect on his or her investing decisions. Humans are prone to abnormal behaviors, which might significantly hinder maximizing wealth (Pashtoon, 2016).

The article aims to investigate whether 3 behavioural finance – overconfidence, representativeness and herding- affect German investors' investment decision and their potential consequences. According to our best knowledge, there is no other study that researches the impact of biases exclusively on German investors. The German financial market however belongs to the most advanced. This article looks at the following demographics in connection with the above-described biases: gender, age, experience, education and frequency.

The number of equity savers in Germany reached a new milestone in 2022, rising to 12.9 million, just above the previous

peak in 2001. Nearly 830,000 more people than the previous year now own shares, equity funds, or equity-based ETFs. According to this, or nearly one in five people, 18.3% of people aged 14 and over participate in the stock market. 14.7%, or just one in seven persons, were affected ten years ago (Deutsche Aktieninstitut, 2023).

The article is organized as follows: The next chapter gives a short overview of the investigated biases. Material and methods describe our research approach (for instance questionnaire, Likert scale, Cronbach Alpha). Results are presented in the same name chapter when they are divided according to biases, gender, education and other factors. Our findings are compared to other studies and deeply explained in Discussion. Conclusion summarizes main points..

2 The essence of the investigated behavioural biases

2.1 Overconfidence bias

Overconfidence is the most debated bias in studies in the field (Ackert and Deaves, 2009). It is defined as a propensity to overestimate one's intelligence, skill, competencies, success expectation, and quality of the information one has and to put excessive trust in one's intuitive abilities (Ricciardi and Simon, 2000; Jha, 2016; Pikulina et al., 2017; Idárraga Calderón, 2018; Zahera and Bansal, 2018). Overconfident investors frequently overestimate their talents while underestimating uncertainties (Bhattacharya, 2012; Jain et al., 2015). They view their past achievement as a reliable indicator of future success (Combrink and Lew, 2020).

Overconfidence is also a byproduct of investors who frequently believe they are better investors than they are. They believe to be able to outperform the market (Singh 2012). They use their information broadly, which might lead to inefficient trading. Additionally, investors trade more frequently and take more significant risks than usual, raising market volatility and mispricing and reducing market efficiency (Waweru et al., 2014; Kasoga, 2021). Through overconfidence, investors can do serious harm to their wealth (Shefrin and Statman, 2000; Baker and Nofsinger, 2002). Daniel and Titman (1999) propose that investor overconfidence may explain the most significant market anomalies, and their study indicates that the investor's overconfidence may produce momentum in stock returns. Cooper et al. (2004) examined this issue and found that a rise in market prices would increase investors' overall overconfidence due to the bias of self-attribution, resulting in higher returns on momentum in the short term after cycles of market gains (Dhankar, 2019).

Women generally have lower confidence levels than men (Bayyurt et al., 2013). In a gender-related investor behavior analysis between 1991 and 1997, Barber and Odean (2001) tested the presumption that more overconfident investors traded (and were predicted to produce poorer results). They found that men traded 45 percent more than women. While women's returns were reduced by 1.72 percent over the same period, men's returns were reduced by 2.5 percent, confirming an over-correlation (Barber and Odean, 2001). Other studies also confirmed that men are mainly vulnerable to this, as they appear to be more overconfident in their trading ability and sell one and a half times more than women (Kliger et al., 2014; Liersch, 2015). When investing in shares, nearly all the effects of overconfidence are detrimental (Fieger, 2017).

2.2 Representativeness bias

Representativeness can be defined as an assessment of the extent of correspondence between the population and the sample (Gilovich et al., 1983). If an investor's previous investment were successful due to his judgments, he would likely make the same

choices in future investments without considering various patterns of uncertainty. This is like making assumptions based on recent previous experience (Masomi and Ghayekhlou, 2011). Investors tend to overreact by trying to acquire hot or strong stocks rather than underperforming ones, which is representational bias (DeBondt and Thaler, 1995; Mahina et al., 2017). This may lead investors to purchase an expensive stock since they may do so when the stock price increases and assume that the growth will continue, neglecting the stock while it is trading below its intrinsic value (Alrabadi et al., 2018). This bias causes investors to use stereotyped data about an investment choice and base their conclusions on examining a few specific cases. (Rasheed et al., 2018; Uribe et al., 2013). They tend to focus just on one aspect of a situation, like a company's previous performance, while ignoring any other information that would be useful in making a more informed choice (Kirs et al., 2001; Raut et al., 2020). Investors with representativeness bias often need to make better investing selections when acquiring stocks since they will attribute a company's positive features directly to its shares (Lakonishok et al., 1994). According to McDowell et al. (2013) and Krawczyk and Rachubik (2019), the representativeness heuristic assesses item similarity and organizes them based on the category prototype.

Kahneman and Tversky (1972) address representativeness by finding the nearest match to historical trends. Individuals attempt to forecast an occurrence and disregard the possibility of following the pattern, assigning too much weight to recent data and too little weight to previous odds or base rate frequencies (Kahneman and Tversky, 1973; Tversky and Kahneman, 1983; Dhankar, 2019). According to Kahneman (2003), people may frequently self-correct and make more accurate decisions when they become aware that they are applying the representativeness heuristic. Shefrin (2000) describes representativeness as a stereotype in overreliance-based decisions, with investors wanting their recent achievements to continue. Barberis et al. (1998) relate heuristic representativeness to overreaction. Investors overvalue a business by misinterpreting recent fast earnings growth to go too far into the future and then get frustrated when the optimistic return from this forecasted earnings growth is not realized (Dhankar, 2019). A significant feature of this heuristic is the so-called "base rate neglect," which means that people appear to disregard previously established information and replace it with one representative instead (Kahneman and Tversky, 1974; Ackert and Deaves, 2009). Male and female investors are both prone to representativeness bias. Female investors rely primarily on previous performance because they feel the return patterns will repeat themselves, whereas male investors make investment decisions focusing on stereotypes (Dickason et al., 2017).

2.3 Herding bias

Herding, in the sense of finance, occurs when stock market actors mimic the actions of each other or a wider group, regardless of whether they take the same judgment personally, resulting in coordinated action. Investors fell into the pit of herding by merely doing what people around them do with their investment decisions (Scharfstein and Stein, 1990; Jordan et al., 2015; Loxton et al., 2020). Herding is the process that happens when people are swayed by the expectations of others when it comes to investment decision-making, as investors instead of gathering private information about possible investment options, they depend on recommendations of popular analysts, their family, friends, or colleagues, or publicly available data in general (Ackert and Deaves, 2009; Forbes, 2009; Malkiel, 2007; Subramaniam and Velnampy, 2017; Almansour and Arabyat, 2017).

People depend less on critical thinking and more on emotions and intuition (Chaudhary, 2013). The idea of peer pressure is a central aspect of herding, both an investor's worry about how people will view his or her decision and the sense or concern that someone moves in a specific direction. They must have a solid justification to do so or have important information leading them in that direction (Valsová, 2016). Nofsinger and Sias (1999)

simplified this by stating that herding is a collective of investors trading in the same direction for a while. Not unexpectedly, individual private investors tend to be influenced by competent financial analysts in their investment decision-making. However, as Welch (2000) found in his report, it is pretty interesting that these trained analysts could also be the victims of herding behavior, especially in revising their recommendations – the propensity to obey the market opinion was very evident. Venezia et al. (2011), on the opposite, investigated that among experienced investors, there was a lower tendency to herd than among amateur investors, which can be due to their financial preparation. Additionally they observed that herding behavior is strongly and substantially associated with the degree of stock market volatility, which poses a more significant problem since Spyrou (2013) demonstrated that during periods of crisis and instability, investors frequently emulate others' acts. This creates a never-ending loop where, as investors panic, herding and market uncertainty intensifies concurrently.

Economists agree that herding harms the economy by destabilizing markets and triggering bubble-like episodes (Andersson et al., 2014; Spyrou, 2013). Bubbles, such as the internet bubble at the end of 1990, are believed to be triggered to a degree by the herding mentality (Forbes, 2009). Research undertaken by Nofsinger and Sias (1999) explores both individual and institutional investors herding behavior. The findings suggest that individual investors display herding behavior as a function of observing patterns, related market signals to other investors, or as a consequence of market overreaction. It is often considered that positive feedback trading is a consideration that can cause investors to herd (Patel et al., 1991; Sirri and Tufano, 1998). Venezia et al. (2011) and Sinha (2015) accepted that herding is primarily due to the existence or lack of information and an inherent lack of faith in one's information (Fieger, 2017). There is also much support that herding is a form of social control in humans where individuals seek to find things in common with others around them and feel better about themselves when their actions are in alignment with their companions (Andersson et al., 2014; Roider and Voskort, 2016; Spyrou, 2013). Mistakes made by the herd as a whole are more satisfying to an individual than a mistake by an individual member of the herd (Ahmad and Mahmood, 2020).

Zainul and Suryani (2021) discovered in their study that female investors in Indonesia are more likely to fall prey to the herding tendency while making financial decisions. The results contrast the findings by Kumar and Goyal (2015), who found that male investors in India are more susceptible to the herding tendency. On the contrary, Jamil and Khan (2016) observed that male and female investors in Oman are equally prone to herd behavior, demonstrating that the investor's gender does not influence the investor's herd behavior.

3 Material and methods

In this study, data collection was conducted through a questionnaire, a crucial quantitative research tool used to gather data for analysis (Acharya, 2010). This method is popular due to its cost-effectiveness and broad applicability (Maier et al., 2000). Questionnaires are particularly useful for quickly collecting information from a large group of people, and standardization of questions is essential to ensure consistency in responses (Siniscalco & Auriat, 2005).

The questionnaire was available in various formats, including online, computer-based, and traditional paper, allowing for easy data comparison from different sources (Kirchhoff et al., 2010). The questionnaire was used for an online survey, and transparency was provided to respondents by disclosing the average processing time and the number of pages at the beginning of the survey to prevent a high dropout rate (Homburg, 2016).

To ensure a representative sample, specific criteria were used to select sub-survey units, including investors who trade actively or passively on the German stock exchange and participants who

understood English. The study aimed to reach its target audience through a professional and private networks, including friends, family, and other doctoral students by email and Whatsapp.

Participants were asked to evaluate their investment decisions based on various biases, and the study aimed to identify prevalent behavioural biases among German investors, focusing on gender differences in responses. The mean values represented as percentages would be used for result comparisons.

Cronbach Alpha was used to test the reliability of the questionnaire. Despite several misunderstandings, misinterpretations, incorrect applications, and even justifications for not being able to evaluate dependability accurately, this indicator is unquestionably one of the most popular, commonly used, and general statistics in research on the design and application of tests (Cortina, 1993; Osburn, 2000; Sijtsma, 2009; Ursachi et al., 2015; Crutzen & Peters, 2017).

If a group of items regularly assesses the same attribute, an individual needs to use this statistic to assist in making that determination. On a uniform 0–1 scale, Cronbach's alpha assesses the degree of agreement. Higher numbers denote more significant agreement (Frost, 2022). High Cronbach's alpha values suggest that each participant's response values are consistent throughout a set of questions. When participants provide a high reaction to one of the items, they are more likely to give a high response to the others. This consistency shows that the measurements are accurate, and the objects may measure the same property. Low values, on the other hand, suggest that the group of items does not dependably measure the same construct. High replies to one question do not imply that participants thought the other items were highly graded. As a result, because the measurements are inaccurate, the questions are unlikely to test the same attribute (Leontitis & Page, 2007; Frost, 2022). It is usually measured against a baseline of 0.7. The items are sufficiently consistent at this level and above to suggest that the measure is reliable (Frost, 2022).

The formula for the Cronbach's alpha is as follows (Leontitis & Page, 2007):

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum s_i^2}{s_x^2}\right)$$

The total number of items or components is k, and α is the reliability coefficient. Where s_x^2 is the variance for all items (the i) on the scale, s_i^2 is the variance of each individual item i, and for the formula, the sum of the variance of each individual item i is needed (Bland & Altman, 1997; Amirrudin et al., 2021). To calculate, at least two items are needed. The problem will be undefined if k is not >1.

The questionnaire uses a Likert scale from 0-5 for the 20 questions about behavioural biases. The following results can be seen if the research values are applied to Cronbach's alpha.

- the number of items/factors, k = 20
- the sum of item variances, $\sum s_i^2 = 37.21$
- the total variance of the scale, $s_x^2 = 183.2$

4 Results

342 German investors made up the study's population. Among these 342 participants, 181 were men, and 161 were women. The age group of 25 to 34 years had the most responses (121), while those over 70 received the fewest (5 responses). The demographic parameters for this study, including age groups and gender, are shown in the table 1.

Table 1: Investor's demographic profile

Demographic variables	Participants (in total)	Participants (%)
Gender		
Male	181	53%

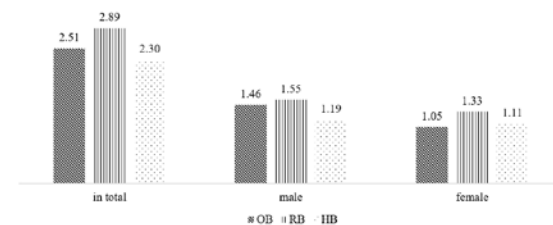
Female	161	47%
Age		
Old investors (>35 years)	184	54%
Young investors (<35 years)	158	46%
Experience		
High experience (>5 years)	97	28%
Low experience (>5 years)	245	72%
Education		
High education (bachelor, master, PhD)	209	61%
Low education (high school, apprenticeship)	133	39%
Frequency		
High frequency (>3 months)	151	44%
Low frequency (>3 months)	191	56%

Source: own work

4.1 Gender

The overconfidence bias had a mean value in a total of 2.51. The males scored higher (1.46) than their female counterparts (1.05). The representativeness bias received a mean value in a total of 2.89. Again, men scored higher (1.55) than women (1.33). The herding bias got a mean value of a total of 2.30. Female German investors scored higher (1.19) than males (1.11). The numbers for each behavioural bias by gender are shown in figure 1.

Figure 1: Overconfidence, representativeness, herding bias – Gender



Source: own work

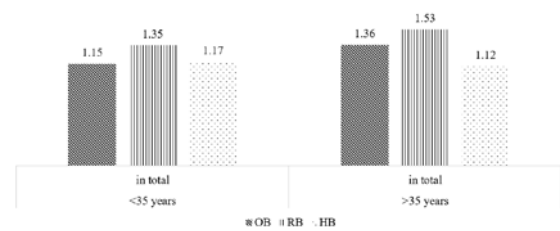
4.2 Age

The participants were divided between old (more than 35 years) and young investors (less than 35 years). 158 German investors were among the younger investor group, and 184 German investors were in the older investor group. We found the following results:

Older investors (1.53) scored higher for the representativeness bias than younger investors (1.35). In contrast, the younger investors scored higher for the herding bias (1.17). The opposite was the case for the overconfidence bias, as the older investors scored higher (1.36) than the younger counterparts (1.15).

This means that the representativeness bias is the strongest (1.35) among younger investors before the herding bias (1.17) and overconfidence bias (1.15). Among the older investors, the tendency for the representativeness bias is the strongest (1.53) as well, followed by the overconfidence bias (1.36) and the herding bias (1.12). Figure 2 shows the numbers.

Figure 2. Overconfidence, representativeness, herding bias – Age



Source: own work

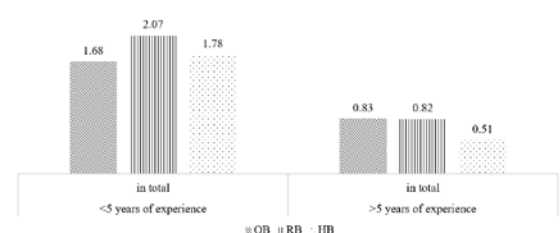
4.3 Experience

Regarding investing experience, 247 German investors had less than five years of investment experience, and 95 German investors had more than five years of investment experience.

Investors with less investing experience are more prone to overconfidence bias (1.68) than highly experienced ones (0.83). Investors with less experience (2.07) are also more susceptible to the representativeness bias than German investors with more experience (0.82). Investors with less investment experience (1.78) are more prone to herding bias than investors with higher investment experience (0.51).

This means that the representativeness bias is the strongest (2.07) among investors with less experience before the herding bias (1.78) and overconfidence bias (1.68). Among the experienced investors, the tendency for the overconfidence bias is the strongest (0.83) as well, followed by the representativeness bias (0.82) and the herding bias (0.51). Figure 3 shows the numbers.

Figure 3. Overconfidence, representativeness, herding bias – Experience



Source: own work

4.4 Education

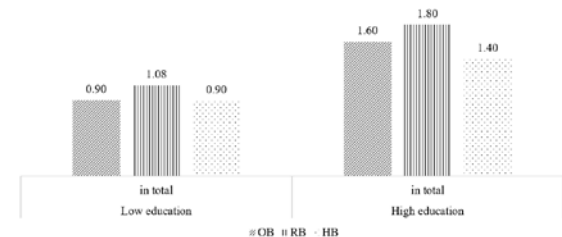
Additionally, it should be researched to see if the three behavioural biases under investigation are influenced by education level. As a result, the 342 respondents were divided into groups according to their level of education. High-education participants were those who had earned a bachelor's, master's, or doctoral degree. However, participants with a high school diploma or an apprenticeship were classified as low-education. 209 German investors were among the group with a high level of education, while 133 German investors were among the group with a low level of education.

Investors with a low education level are less prone to overconfidence bias (0.90) than highly experienced ones (1.60). Investors with a lower educational level (1.08) are also less susceptible to the representativeness bias than German investors with a higher education (1.80). Investors with less education (0.90) are less prone to herding bias than investors with higher investment experience (1.40).

This means that the representativeness bias is the strongest (1.08) among investors with a low educational level before the herding bias (0.90) and overconfidence bias (0.90) with the same value. Among the high educational investors, the tendency for the representativeness bias is the strongest (1.80) as well,

followed by the overconfidence bias (1.60) and the herding bias (1.40). Figure 4 shows the numbers.

Figure 4. Overconfidence, representativeness, herding bias – Education



Source: own work

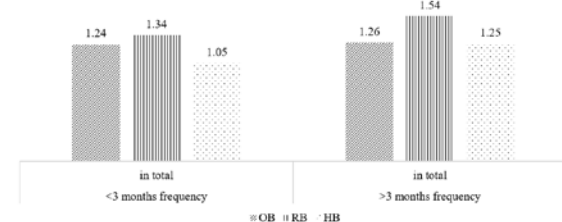
4.5 Investing frequency

In addition, it will also be interesting to see if the German investors' frequency influences the three investigated behavioural biases among German investors. The respondents were separated by high investing frequency if they invested in a timeframe of more than three months and low investing frequency if they invested in a timeframe of less than three months. Among the 342 German investors, 191 were low-frequency investors, and 151 were high-frequency investors.

High-frequency investors (1.26) are more prone to overconfidence bias than low-frequency investors (1.24). Investors with a high frequency (1.54) are also more susceptible to the representativeness bias than German low-frequency investors (1.34). High-frequency investors are more prone (1.25) to herding bias than low-frequency investors (1.05).

This means that the representativeness bias is the strongest (1.54) among high-frequency investors before the overconfidence bias (1.26) and herding bias (1.25). Among the low-frequency investors, the tendency for the representativeness bias is the strongest (1.34) as well, followed by the overconfidence bias (1.24) and the herding bias (1.05). The following figure shows the numbers.

Figure 5. Overconfidence, representativeness, herding bias – Investing frequency



Source: own work

Table 2 summarizes all above described results.

Table 2. Demographics influencing behavioural biases

Demographics		Overconfidence bias	Representativeness bias	Herding bias
Gender	Male	1.46	1.55	1.19
	Female	1.05	1.33	1.11
Age	Old (>35 years)	1.15	1.35	1.17
	Young (<35 years)	1.36	1.53	1.12
Experience	High level (>5 years)	0.83	0.82	0.51
	Low level (<5 years)	1.68	2.07	1.78
Education	High level	1.60	1.80	1.40
	Low level	0.90	1.08	0.90
Investing frequency	High (>3 months)	1.26	1.54	1.25
	Low (<3 months)	1.24	1.34	1.05

Source: own work

5 Discussion

5.1 Overconfidence bias

The results from the study are consistent with those of Prosad et al. (2015), who investigated whether Indian investors in the Delhi/NCR region had an overconfidence bias. It also looked into how demographics and investment intelligence may affect the bias. The poll results indicate that the overconfidence bias depends on the demographics of investors and the trading expertise, with age, occupation, and trading frequency having the most influence.

When making investment selections among 600 respondents from the Indian city of Gurugram, Sharma et al. (2022) looked at the impact of demographic factors on several behavioural dispositions of individual investors. Gender, age, educational attainment, employment, and yearly income are among the demographic factors that have been studied that significantly affect the overconfidence bias.

The link between investors' rationality and behavioural biases like overconfidence was experimentally examined by Mushinada et al. (2019) among 384 Indian investors. The findings demonstrate that overconfidence bias is influenced by an investor's traits, including gender, age, employment, yearly income, and trading experience.

Among 500 individual investors in India, Baker et al. (2019) looked at the relationship between behavioural biases and financial literacy and demographic factors (gender, age, income level, education, employment, marital status, and investing experience). The findings show that among Indian investors, overconfidence, representativeness, and herding are evident. The most significant demographic factors that correspond to the behavioural biases of individual investors in the sample are age, employment, and investing experience. In terms of gender, men are more overconfident in their stock market expertise than women are.

The impact of demographic factors, including age, gender, income, and occupation, on investor behavioural biases, such as overconfidence bias, was studied by Elizabeth et al. in 2020. The study involved 151 stockholders on the Indonesia Stock Exchange who were at least 17 years old. The study's findings demonstrated that gender and income impacted overconfidence bias.

In their study, Baker et al. (2018) explored the relationship between a person's propensity to engage in behavioural biases and their age, experience, education, and gender. The study's results demonstrate that SME owners are prone to overconfidence bias using responses from 154 Indian SME owners. The likelihood of engaging in behavioural biases is greatly influenced by gender, age, and experience.

Investigating trading behavior among 491 Thai retail investors in 2016, Paisarn et al. (2021) looked at the traits and behavioural patterns that cause investor prejudice. They discover that investors frequently have biases and that males are more overconfident than women. Additionally, they find that an investor's age, income, and trading experience affect their investing behavior. This research supports the conclusions published for Turkey, India, and Vietnam, showing that demographic characteristics might help differentiate investors based on the severity of their overconfidence bias.

In a study of 391 people in Pakistan, Hassan et al. (2014) looked at how gender and age affected two behavioural biases: overconfidence and loss aversion. According to the research, men and older investors were more overconfident.

233 Swedish private investors were the subjects of an investigation by Gustavsson and Svenler (2020) to determine if there is an overconfident bias present and whether demographic parameters such as gender, age, marital status, education, and

experience affect the degree of overconfident behavior. The results indicate that Swedish private investors are overconfident. Results with statistical significance show that overconfident behavior is influenced by gender, age, education, and experience.

Mwaka (2013) used the behavioural finance theory to describe how a person's demography impacts decisions about investing. Gender, age, education, and income are the demographic factors examined. Results indicated that gender, age, and education all impacted the overconfidence bias.

To examine the impact of demographic variables on rational decision-making processes and how those differences manifest themselves in the form of behavioural biases, Kumar and Goyal (2016) looked at the relationship between rational decision-making and behavioural biases among 386 individual investors in India. The results demonstrate that gender and income significantly affect the ability to make reasonable decisions. In India, male investors are more likely to exhibit overconfidence.

On the contrary, other findings only confirmed partial demographic influences on the overconfidence bias.

In Taiwan, Lin (2011) examined the effects of demographic factors on the behavioural biases of 430 respondents who were voluntary individual investors. There is evidence that gender influences the overconfidence bias, but there is little to no evidence that employment or the amount of yearly income does. In his study, Koc (2021) sought to uncover the factors influencing overconfidence bias in a sample of Turkish institutional investors. The independent factors in the study include age, gender, marital status, education, having children, and institutional investment experience. The findings revealed that only education level and marital status substantially impact overconfidence bias.

The impact of demographic characteristics, including gender, age, education, employment, income, and investing experience, on investor behavior biases, such as overconfidence bias, was studied by Beatrice et al. in 2021. To perform this study, questionnaires were sent to 152 investors listed on the Indonesia Stock Exchange who were at least 17 years old. The findings demonstrated that only investment experience had an impact on overconfidence bias.

Other findings showed that there were no demographic influences on the overconfidence bias.

225 respondents in Pakistan who were bankers, finance students, and investors were studied by Bashir et al. (2013) to determine the effects of demographics (residential area, age, gender, marital status, educational background) as well as personality traits (extraversion, openness, conscientiousness, neuroticism, and agreeableness), on the overconfidence bias. The findings indicate that personality qualities affect the overconfidence bias, but demographics have no discernible link.

In their work, Pandey and Dhami (2021) investigated how the respondents' behavioural biases, who were among 100 college and university professors in Punjab, were affected by the respondents' demographic features. The results revealed that age, gender, job title, and years of experience did not substantially affect the overconfidence bias.

5.2 Representativeness bias

Results in the literature do not agree with these findings, as most researchers find the representativeness bias partially influenced by demographic variables.

Among 500 individual investors in India, Baker et al. (2019) looked at the relationship between behavioural biases and financial literacy and demographic factors (gender, age, income level, education, employment, marital status, and investing experience). The findings show that among Indian investors,

overconfidence, representativeness, and herding are evident. The most significant demographic factors that correspond to the behavioural biases of individual investors in the sample are age, employment, and investing experience.

When making investment selections among 600 respondents from the Indian city of Gurugram, Sharma et al. (2022) looked at the impact of demographic factors on several behavioural dispositions of individual investors. Gender, age, employment, and yearly income are demographic factors that significantly affect the representativeness bias, although educational background has less bearing.

In their work, Pandey and Dhimi (2021) investigated how the respondents' behavioural biases, who were among 100 college and university professors in Punjab, were affected by the respondents' demographic features. The results demonstrated that neither gender nor designation substantially impacted the representativeness bias, only age and years of experience.

In his research, Koc (2021) sought to understand the variables that influenced the sample of Turkish institutional investors' overconfidence biases and representativeness. As independent factors, the research considers institutional investors' age, gender, marital status, educational attainment, having children, and experience. Results indicated that only gender, experience level, and education degree significantly impacted representativeness bias.

At the Nairobi Securities Exchange in Kenya, Onsomu et al. (2017) performed research to ascertain how demographics affect investor biases among individual investors. A cross-sectional analysis of 279 investors for the year 2015 was conducted. Age, education, and experience did not significantly alter investor representativeness bias in demographics. However, the impact of investor prejudices was significantly influenced by gender, with males being more impacted than women.

5.3 Herding bias

The findings are in sync with the findings by Mwaka (2013), who used Behavioural Finance Theory to describe how demographic variables influence investor behavior. Gender, age, education, and income are the demographic parameters studied. Gender, age, and education were found to impact herding bias.

Nair et al. (2017) examined the effects of 52 respondents' cognitive biases on the demographics and different financial information sources of Indian stock investors. The herding behavior of stock investors is significantly influenced by gender, age, marital status, and word of mouth.

Hussain et al. (2022) used data from 210 investors trading at the Pakistan Stock Exchange to examine the impact of the herding bias and demographic disparities among investors. The findings demonstrated that income, occupation, and age considerably influenced the herding tendency.

The presence of herding bias among Indian investors in the Delhi/NCR region was investigated by Prosad et al. in 2015. It also looks into how demographics and investment intelligence may affect the bias. The poll results indicate that the herding bias depends on the demographics of investors and the complexity of their trading, with age, occupation, and trading frequency having the most influence.

Among 418 Nepalese investors, Pandit and Chitwan (2018) investigated the presence and impact of behavioural bias, specifically herding prejudice. This study demonstrates that the herding theory still holds even among experienced, educated, and regular traders. Additionally, the herding tendency is influenced by gender, age, profession, and income.

Among 500 individual investors in India, Baker et al. (2019) looked at the relationship between behavioural biases and financial literacy and demographic factors (gender, age, income

level, education, employment, marital status, and investing experience). The findings show that among Indian investors, overconfidence, representativeness, and herding are evident. The most significant demographic factors that correspond to the behavioural biases of individual investors in the sample are age, employment, and investing experience.

To examine the impact of demographic variables on rational decision-making processes and how those differences manifest themselves in the form of behavioural biases, Kumar and Goyal (2016) looked at the relationship between rational decision-making and behavioural biases among 386 individual investors in India. The results demonstrate that gender and income significantly affect the ability to make reasonable decisions. In India, male investors are more likely to exhibit herd mentality.

Other studies partially agreed with our findings, as not all investigated demographic variables influenced the herding bias. Sarkar and Sahu (2018) examined the stock market investing behavior of 400 randomly chosen individual investors from different West Bengal districts to see if three independent variables, including demographic considerations, impacted their choices. The findings indicate that the herding tendency is significantly influenced by age, employment, and yearly income but not by experience or investing goals.

In Taiwan, Lin (2011) examined the effects of demographic factors on the behavioural biases of 430 valid respondents who were voluntary individual investors. Age and gender affect the herding tendency, but there is no evidence that employment or the amount of yearly income has an effect.

In their study, Elvira et al. (2022) examined the influence of demographics and financial literacy on the behavioural biases of 204 investors in Indonesia. According to the findings, the herding bias is affected by financial literacy and occupation but not by age or income.

When making investment selections among 600 respondents from the Indian city of Gurugram, Sharma et al. (2022) looked at the impact of demographic factors on several behavioural dispositions of individual investors. The herding bias is significantly influenced by the demographic factors of gender, age, and yearly income but not by employment or educational background.

225 respondents in Pakistan who were bankers, finance students, and investors were studied by Bashir et al. (2013) to determine the impact of demographics (residential area, age, gender, marital status, educational background) and personality traits (extraversion, openness, conscientiousness, neuroticism, and agreeableness) on the herding bias. The findings demonstrate that personality factors affect overconfidence bias, but demographics are not associated with herding prejudice.

The impact of demographic factors, including age, gender, wealth, and occupation, on investor behavioural biases, such as the herding bias, was studied by Elizabeth et al. in 2020. The study involved 151 stockholders on the Indonesia Stock Exchange who were at least 17 years old. The study's findings demonstrated that only the profession impacted the herding behavior bias.

The impact of demographic characteristics, including gender, age, education, employment, income, and investing experience, on investor behavior biases, such as overconfidence bias and herding prejudice, was studied by Beatrice et al. in 2021. To perform this study, questionnaires were sent to 152 investors listed on the Indonesia Stock Exchange who were at least 17 years old. The findings demonstrated that age and profession were the only factors influencing herding bias.

In their research on 166 individual Retail Investors of the Pakistan Stock Exchange, Sabir et al. (2020) sought to emphasize the influence of demographic characteristics on the herding behavior of investors with the moderating role of

Islamic religiosity. The findings indicate that while gender does not affect herding behavior, age and income do.

Among the literature, one example was that the findings showed no influence of demographic variables on the herding bias. In their work, Pandey and Dharmi (2021) investigated how the respondents' behavioural biases, who were among 100 college and university professors in Punjab, were affected by the respondents' demographic features. The results demonstrated that age, gender, job title, and years of experience did not significantly affect the herding bias.

6 Conclusion

This study looked at how behavioural biases affected the investing choices made by German investors. 342 German investors were given a questionnaire to complete, which was then used to debate and evaluate behavioural biases. The behavioural biases that this study focused on were overconfidence, representativeness, and herding. The issue was whether or whether factors like gender, age, experience, education, and frequency of investing had an impact on the behavioural biases of German investors and the ensuing investment judgments. The findings of the study imply that behavioural biases and demographics have an impact on German investors.

We specifically discovered that male German investors are more prone to three biases (overconfidence, representativeness, and herding) than females. Younger investors (<35 years) are more prone to overconfidence and representativeness biases, while older investors (>35 years) are at greater risk of the herding bias. Additionally, less experienced investors (<5 years) and those with a higher education level (i.e., university) tend to show these biases more, and investors who trade more frequently (> three months) demonstrate higher levels of all three biases compared to less frequent traders (<3 months).

Our findings emphasized once more how irrational the decision-making processes of financial market players are. Biases are deeply ingrained in an investor's subconscious thinking, and they nearly dictate every choice he makes. Behavioural finance seeks to address these biases to help individual investors deal with them.

Additionally, behavioural biases among investors have been shown to have a significant impact on how people spend, save, and invest. The emotional makeup of society and the brain's information-processing shortcuts are to blame for these behavioural biases. Because of this, the majority of investors experience the prevailing prejudices that induce them to behave poorly and maybe go against their best interests.

Furthermore, market swings induced by the pandemic and inflation crises show that investor behavior fluctuates over time, making this research incredibly difficult to conduct to acquire a deeper understanding of investor behavior. Investor behavior can be also impacted by a variety of factors that influence an investment or trading decision. As a consequence, factors including the traded stock industry and the business cycle, among others, tend to impact investment behavior. Some biases are assumed to feed off of one another, and the external environment and other biases in the process are two factors that influence bias intensity. However, while certain biases may be avoided in specific contexts, they cannot be completely eliminated.

According to the study, behavioural biases have influenced human judgment, and future research might look at other biases and demographic characteristics. It might also be claimed that, for whatever reason, making financial decisions can be difficult, causing many people to act impulsively at times. The same people, on the other hand, are more likely to feel at ease and in a better frame of mind while filling out a questionnaire, so they opt to react in a way that may represent them in a different light, especially in the context of hypothetical scenarios.

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Primary Paper Section: A

Secondary Paper Section: AH

ASSESSING THE RISK OF A TERRORIST ATTACK AGAINST A SOFT TARGET: THE USE OF EXPERT OPINION IN THREAT ASSESSMENT

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Abstract: The article reviewed the methods for assessing the risks of a terrorist attack against a soft target. Considering the number of factors affecting the choice of a target by a terrorist group or individual terrorists and the limited usability of historical data on previous terrorist attacks, the article further focuses on the possibility of using expert opinion on the importance of criteria for identifying soft targets. For this purpose, a questionnaire survey was conducted at the regional police directorates of the Police of the Czech Republic. Based on the survey results, the level of security, the number of persons, and its symbolic significance were identified as the most important criteria for selecting a soft target as a target of a terrorist attack.

Keywords: expert opinion, multicriteria decision making, risk, soft targets, terrorist attack, threat assessment

1 Introduction

Soft targets or crowded places (from now on referred to only as "soft targets") are usually understood to be places vulnerable to a violent or terrorist attack, where large numbers of people congregate (Australia-New Zealand Counter-Terrorism Committee, 2017a, European Commission, 2017). Thus, soft targets can potentially include a disparate group of spaces, events, or objects such as churches, restaurants, gatherings, music festivals, hospitals, schools, means of transport, and many others that can become the target of a terrorist attack. Given the sheer number of potential soft targets, it is virtually impossible to harden all of these possible targets adequately. In such a situation, a suitable solution is to perform a risk assessment to identify and prioritize the most vulnerable soft targets. Identifying the most endangered soft targets could be potentially very useful, as the terrorists themselves usually deliberately choose the targets of their attacks (for review, see Gill et al., 2020, or Marchment & Gill, 2022). Unfortunately, assessing the risks of a terrorist attack against a potential soft target runs into several fundamental issues.

The fundamental problem is estimating the probability of a terrorist attack on a specific soft target. In 2004, Garrick et al. (2004) recommended the use of quantitative risk assessment consisting of threat and vulnerability assessment. Garrick et al. (2004, p. 136) defined the threat as "the intention of a terrorist to inflict harm or damage to a specific asset or target by a specific means or weapon" and the vulnerability as "the response of an asset or target to a terrorist attack, including the consequences of the attack." Several other studies have also recommended using methods based on probabilistic risk assessment to assess the risks of a terrorist attack, e.g. Paté-Cornell & Guikema

(2002), Kujawski & Miller (2007), Ezell et al. (2010), Chatterjee & Abkowitz (2011) or Grant & Stewart (2017).

Problems associated with estimating the probability of a terrorist attack have, however, led to some controversy regarding the appropriate methodology for assessing terrorism risks. Several studies, e.g. Cox (2008), Brown & Cox (2011), or Aven & Guikema (2015), argued that probabilistic risk assessment, although very useful when assessing natural hazards or accidents, is not an appropriate solution for assessing the risks of a terrorist attack. Both Cox (2008) and later Brown & Cox (2011) pointed out several methodological flaws, including the fact that the vulnerability of the target of a terrorist attack, i.e. the probability that an attack on this target will be successful, also indirectly affects the probability that the target will become the target of this attack, as the attacker usually tends to choose targets with the highest probability of success.

As Aven & Guikema (2015) noted, the problem is that once a soft target is considered a likely target of a terrorist attack, measures are usually taken to increase its security level. On the other hand, the success of a terrorist attack depends substantially on choosing a vulnerable soft target. Therefore, it can be reasonably assumed that some attackers may intentionally choose such soft targets that are not considered likely targets of a terrorist attack (Kennedy et al., 2011). This link led Aven & Guikema (2015) to question the usefulness of probability estimation in assessing the risks of a terrorist attack. As Aven & Guikema (2015, p. 2163) noticed, "any probability assessment is conditioned on future choices made by both the attacker(s) and defender(s)".

Guikema & Aven (2010) delimited and reviewed several alternative approaches to probability risk analysis that may be used for terrorism risk: a) risk management based on highest valued systems, b) game theory, c) probabilistic risk analysis based on expert knowledge, or d) a semi-quantitative risk analysis. At least the latter two approaches rely on expert opinion, which can also be problematic. Garrick et al. (2004) advocated the use of "subjective" probability based on expert opinion in the case of a lack of data on the frequencies of occurrence of individual scenarios, but some others were far more skeptical. Aven (2007) criticized the use of "subjective" probability, as there is no clear link between it and objective probability, which can lead to fundamental bias. According to Aven & Guikema (2015), subjective probability often tells more about the knowledge of the expert(s) involved than about the objective probability of the analyzed scenario of a terrorist attack.

Regardless of the method used to estimate the probability of the realization of a terrorist attack scenario and the probability of its success, even estimating the consequences of a terrorist attack is far from being without problems. The severity of consequences, especially lethality, of a terrorist attack scenario depends on several factors. In addition to the attacker's preparedness, his decisions and actions during the attack (for details see Alakoc, 2017, or Turner et al., 2021), and the existing security measures, how threatened persons in the soft target react to the attack is also of high importance. For example, Cuesta et al. (2019), in their method for assessing the risks of a terrorist attack, also consider the probability that people will manage to evacuate before the attack. The need to estimate the probability of successful evacuation during a terrorist attack introduces another source of uncertainty into the risk assessment process. Although several models, e.g. Yu et al. (2022) or Liu et al. (2024), have been developed for crowd evacuation during a terrorist attack, individual models still have limitations due to the complexity and variability of crowd behavior during panic.

Given the above, the possibility of using data on previous terrorist attacks to estimate the probability of future attacks and

the probability of success of these attacks is generally limited, as pointed out by Fagel & Hesterman (2017). Terrorists' target preferences change significantly over time, depending on several factors, especially the ideology of the attackers and the presence or absence of support from the local civilian population, as has been repeatedly documented (e.g. Becker, 2014, Ahmed, 2018, Polo, 2019, or Schmeitz et al., 2022). As a result, there are significant regional differences in the choice of targets for terrorist attacks, as evidenced by some studies (e.g. Anarumo, 2011; Zeman et al., 2022). Given these circumstances, the possibility of obtaining a sufficiently reliable estimate of the probability of carrying out a terrorist attack against a specific soft target is at least uncertain in most cases. Nevertheless, historical data is still commonly used for terrorism risk assessment (e.g. Grant & Stewart, 2017, or Li et al., 2017).

Due to the limited usefulness of historical data on terrorist attacks in risk assessment, this article focuses on the possibilities of using expert opinion in threat assessment concerning the risk of a terrorist attack on a soft target. The threat is perceived here as the probability of a terrorist selecting the assessed soft target as the target of a terrorist attack. Given the regional differences in the tactics of carrying out terrorist attacks, as described above, the article builds on the assumption that the included group of experts must have extensive knowledge of the security situation and extremist groups in the given region. Considering the above, this article aims to determine the criteria and their weights for assessing the threat of a terrorist attack on soft targets in the Czech Republic based on an expert assessment by police officers responsible for ensuring the protection of soft targets in the country. The defined criteria and their weights can be used not only as part of risk assessment for a soft target but especially for identifying soft targets in the Czech Republic and their ranking according to the threat level.

2 Methods

The criteria for identifying soft targets were chosen so that they were easy to assess and, at the same time, closely related to the essential characteristics of soft targets. The following criteria were selected (a detailed description of the individual criteria is given in Tab. 1):

- a) the number of persons in the soft target,
- b) the symbolic significance of the soft target,
- c) the level of security,
- d) the presence of mass media,
- e) the availability of information about the soft target,
- f) the layout of the building.

The symbolic significance of a soft target and its security level are considered essential factors in the attractiveness of a soft target for attackers, which is also described by the other soft target identification tools (e.g. Australia-New Zealand Counter-Terrorism Committee, 2017b, Karlos & Larcher, 2020). The symbolic significance is closely related to the accessibility of the soft target for the public and the predictability of the presence of a high number of people. The predictability of the presence of a high number of people is also significantly influenced by the interest and presence of the mass media (Australia-New Zealand Counter-Terrorism Committee, 2017b). The importance of the presence of mass media as a factor increasing the attractiveness of a soft target for an attacker has also been emphasized by the last Czech *Framework for Soft Targets Protection* (Ministry of the Interior of the Czech Republic, 2017).¹ The availability of soft target information was included among the criteria because it is a potential indicator of public accessibility, predictability of the presence of a large number of people, and vulnerability to simple attack techniques. Although the Czech *Framework for Soft Targets Protection* does not mention the availability of information about a soft target as a risk factor, it is assessed as a risk factor, for example, in the *Crowded Places Self-Assessment Tool* (Australia-New Zealand Counter-Terrorism Committee, 2017b). The last criterion, i.e., building layout,

assesses the vulnerability of soft targets to simple attack techniques and the security level of soft targets, as the choice of the target of a terrorist attack can also be determined by its vulnerability, as reviewed above.

Tab. 1: Description of used criteria.

Criterion	Description
Number of persons	Expresses the maximum number of people expected to be in the building or at the event site at any one time.
Symbolic significance	Includes the religious or social importance of the soft target. A soft target with symbolic significance is one that is widely known or receives regular media attention and is perceived by a significant segment of the population or a particular religious group to be important to society or a particular religion because of its historical, cultural, institutional, or other significance in terms of the values with which the soft target is associated.
Level of security	Includes the level of security of a building or event site, in particular police presence, security presence and access control to the building or event site.
Mass media presence	Mass media presence means the presumed presence of mass media, particularly television, within a soft target, whilst information about their presence is publicly known or can be assumed due to the nature of the event.
Availability of information	Expresses a condition where information is publicly available, e.g., on the Internet, which can be used to prepare a terrorist attack against a soft target, e.g., a detailed building plan.
Building layout	Includes the properties of a building, particularly construction and operational features that can be used to carry out a terrorist attack, e.g., the accumulation of people outside a protected zone or the possibility of a vehicle attack.

Based on the defined criteria, a questionnaire was created for pairwise comparison of these criteria. For each pairwise comparison, respondents were asked to comment on the importance of the compared criteria in relation to the likelihood of a terrorist attack on a scale of integers from 1 to 9, where one expresses the equal importance of both criteria and nine the extreme importance of the preferred criterion compared to the non-preferred criterion, as recommended by Saaty (2004, p. 6). The questionnaire was subsequently distributed to 14 regional police directorates of the Police of the Czech Republic. The questionnaire was filled in and returned by 23 respondents at the regional police directorates responsible for ensuring the protection of soft targets within individual regions.

The weights of the individual criteria were determined using the technique described by Saaty (2004). First, a matrix of pairwise comparisons was constructed for each respondent based on their responses. The consistency index (CI) and consistency ratio (RI) were then calculated for each pairwise comparison matrix using the procedure according to Saaty (2008, pp. 263-265). Only pairwise comparison matrices that did not show a high level of inconsistency ($CR \leq 0,2$) were included in the subsequent analysis. The matrices that were not excluded as inconsistent were then used to calculate the overall pairwise comparison matrix A, with each element of this matrix calculated as the geometric mean of the corresponding elements of the original pairwise comparison matrices. Based on matrix A, the criteria weights were determined through an iterative process recommended by Saaty (1990, p. 19). The following steps were performed as part of each iteration:

¹ Although this is a framework for 2017-2020, a newer one has not been published in the Czech Republic at the time of submitting this article.

- 1) The B_i matrix was calculated as the i -th power of the matrix A ;
- 2) The vector v_i was calculated as row sums of matrix B_i ;
- 3) The normalized vector w_i was obtained as vector v_i divided by the sum of its components;
- 4) For $i > 1$, the vector d_i was calculated as the difference between the normalized vector w_i and the normalized vector from the previous iteration w_{i-1} . The iteration process was completed if all the components of the vector d_i were less than 10^{-4} . The resulting vector w_i was then used as the final vector of criteria weights.

All calculations were performed in the R software (R Core Team, 2023).

3 Results and Discussion

The obtained pairwise comparisons of criteria were burdened by significant inconsistency in the evaluation of the importance of the criteria by individual respondents. Only 8 out of 23 respondents met the required level of consistency ($CR \leq 0,2$). The ratings given by these respondents were subsequently used to determine the criteria weights. The high level of inconsistent answers testifies, in addition to the higher number of compared criteria, to the complexity of the problem of identifying the most endangered soft targets.

First, criteria weights were calculated separately for the opinions of 8 respondents whose answers were sufficiently consistent. Standard deviations were then calculated for individual criteria to measure variability in the respondents' assessment of the importance of the criteria. For most of the criteria, the differences between respondents were relatively low, as can be seen in Tab. 2. However, the respondents differed considerably in their assessment of the importance of the symbolic significance of a soft target in relation to the probability of a terrorist attack. This may be caused by the fact that the importance of symbolic significance in the selection of a soft target as a target of a terrorist attack is closely linked to the ideology of terrorists, which shows marked regional differences, as noticed by Anarumo (2011).

Tab. 2: Standard deviations (SD) for criteria weights calculated based on the answers of eight respondents with a low degree of inconsistency.

Criterion	SD
Number of persons	0.07
Symbolic significance	0.17
Level of security	0.1
Mass media presence	0.06
Availability of information	0.09
Building layout	0.08

Subsequently, the overall matrix of pairwise comparisons was calculated based on the answers of all eight respondents, and the weights of the individual criteria were determined. The obtained matrix of pairwise comparisons is presented in Tab. 3. The matrix proved to be sufficiently consistent with $CR < 0.01$.

Tab. 3 Overall matrix of pairwise comparisons based on the answers of eight respondents with a low degree of inconsistency.

	NP	SS	LS	MMP	AI	BL
NP	1	0.904	0.825	3.174	2.225	1.622
SS	1.107	1	0.825	3.424	2.128	1.167
LS	1.212	1.212	1	4.338	2.29	2.087
MMP	0.315	0.292	0.231	1	0.413	0.397
AI	0.45	0.47	0.437	2.42	1	0.613
BL	0.616	0.857	0.479	2.517	1.631	1

Note: NP – number of persons, SS – symbolic significance, LS – level of security, MMP – mass media presence, AI – availability of information, BL – building layout

The calculated weights of individual criteria are shown in Tab. 4. The respondents considered the level of security in the soft target, the number of people in the soft target, and its symbolic significance to be the most important criteria.

Tab. 4: Criteria weights calculated based on the answers of eight respondents with a low degree of inconsistency.

Criterion	Weight
Number of persons	0.21
Symbolic significance	0.21
Level of security	0.26
Mass media presence	0.06
Availability of information	0.11
Building layout	0.15

The high importance of the security level is consistent with the assumption that attackers try to avoid targets with a high security level to increase their chances of successfully executing an attack, as several studies have pointed out (e.g. Brown & Cox, 2011, Kennedy et al., 2011, or Aven & Guikema, 2015). Respondents' assessment is also consistent with the latest Czech *Framework for Soft Targets Protection* (Ministry of the Interior of the Czech Republic, 2017), which considers the absence or a low level of security as one of the two essential characteristics of a soft target.

According to the respondents, the second most important criterion was the number of people in the soft target. The high priority assigned to that criterion is not surprising since a high number of people is considered an essential feature of a soft target by strategic documents in the Czech Republic (Ministry of the Interior of the Czech Republic, 2017) and at the level of the European Union (European Commission, 2017), but also by strategic documents of other countries (e.g. Australia-New Zealand Counter-Terrorism Committee, 2017a). However, it is very interesting that the respondents considered the number of people a less important criterion than the level of security in the soft target.

The most interesting finding was the high priority assigned by the respondents to the symbolic significance of the soft target. Neither the latest Czech *Framework for Soft Targets Protection* (Ministry of the Interior of the Czech Republic, 2017) nor the definition of the European Commission (2017) include symbolic significance among the basic features of soft targets. The Czech Framework ranks the symbolic significance of a soft target only among the properties that can increase the attractiveness of a soft target for an attacker. At the same time, the Framework lists it in the last place among these properties. Neither the relevant methodology for threat assessment issued by the Ministry of the Interior of the Czech Republic (Kalvach & Vangeli, 2018) attaches particular importance to the symbolic significance of a soft target. It is, therefore, unlikely that respondents would be influenced in their judgment by strategic or methodological documents issued in the Czech Republic. This is apparently also reflected in the higher variability of individual respondents' answers, as can be seen in Tab. 2.

The importance of symbolic significance in choosing the target of a terrorist attack was also demonstrated by some conducted studies. Most notably, Marchment et al. (2020) have shown that lone actor terrorists are willing to travel from their residence to carry out an attack on a target with symbolic significance significantly further than when attacking other targets.

4 Conclusion

Based on the expert opinion of respondents from regional police directorates of the Police of the Czech Republic, the level of security, the number of persons, and the symbolic significance were identified as the most important criteria for selecting a soft target as a target of a terrorist attack. While the high importance assigned to the number of people and the level of security of the soft target corresponds to strategic and methodological documents relevant to the Czech Republic, the emphasis on the

importance of the symbolic significance of the soft target can be considered a very interesting result. Moreover, this finding is consistent with the results of recent research based on the evaluation of historical data on terrorist attacks. On this basis, the inclusion of symbolic significance in the soft target identification process and the development of techniques and tools for assessing the level of symbolic significance of soft targets for different groups of potential attackers can be recommended.

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Primary Paper Section: A

Secondary Paper Section: AQ

B PHYSICS AND MATHEMATICS

BA	GENERAL MATHEMATICS
BB	APPLIED STATISTICS, OPERATIONAL RESEARCH
BC	THEORY AND MANAGEMENT SYSTEMS
BD	INFORMATION THEORY
BE	THEORETICAL PHYSICS
BF	ELEMENTARY PARTICLE THEORY AND HIGH ENERGY PHYSICS
BG	NUCLEAR, ATOMIC AND MOLECULAR PHYSICS, ACCELERATORS
BH	OPTICS, MASERS AND LASERS
BI	ACOUSTICS AND OSCILLATION
BJ	THERMODYNAMICS
BK	LIQUID MECHANICS
BL	PLASMA PHYSICS AND DISCHARGE THROUGH GASES
BM	SOLID-STATE PHYSICS AND MAGNETISM
BN	ASTRONOMY AND CELESTIAL MECHANICS, ASTROPHYSICS
BO	BIOPHYSICS

DEVELOPMENT OF ELECTRICITY AND GAS PRICES

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Abstract: Energy prices are a widely discussed topic and their development influences everyday life of every person. This paper deals with the development of electricity and natural gas prices in the years 2017 – 2022 with the aim to evaluate this development and determine the impact of extreme events on this development. For the purposes of describing the development, the descriptive analysis of electricity and natural gas time series was used. The impact of extreme events represented by the COVID-19 pandemic was determined using the correlation analysis. The results show that in the monitored period, the development of electricity prices was more stable than the prices of natural gas. However, the correlation between the average increment in the number of patients with COVID-19 and the prices of energy commodities could not be confirmed. To prove the influence of the above extreme events, a more complex analysis would be necessary, which would include other factors that could have an impact on energy prices.

Keywords: Electricity, natural gas, price development, extreme events, correlation.

1 Introduction

Most households and businesses are dependent on energy supplies, which also account for a major part of their expenditure. A large increase in energy prices can thus have a negative impact on their activities, which makes energy commodities some of the most monitored ones on the market. Martins, Felgueiras and Caetano (2022) consider energy availability and affordability to be essential requirements in eradicating poverty or ensuring access to goods or water. At the same time, they consider modern life to be dependent on electrical appliances and devices, which makes energy prices a key factor for people. Energy is also essential for industries and can affect industrial productivity; energy price fluctuations can have an impact on the level of final energy consumption (Xu et al., 2022).

It has been confirmed in the past that there are interactions between energy markets and other raw materials markets. Price rises and fluctuations in commodity markets can thus have considerable political and economic consequences. Although these fluctuations can be observed in all types of commodities, it is energy which is currently being paid much attention to (Spärgberg, 2020). A causal relationship has been found to exist between the prices of energy and food. In the context of agricultural development, there has been an increase in energy consumption as well as in the dependence on energy in agricultural production. Therefore, it is advisable to reduce the consumption and dependence by replacing the energy sources used with alternative “free” sources (Kirikkaleli and Darbaz, 2021).

Like other commodities, energy prices can also be influenced by extreme events. The link between these natural or human-related extreme events and energy prices is very significant, since such events have considerable impact on the financial risk in the energy sector (Wen, Zhao and Chang, 2021). A recent example is the COVID-19 pandemic, which has caused a significant drop in energy prices, thus affecting negatively the global economy. In the short run, energy prices turned out to be very sensitive to the uncertainty caused by the pandemic. Compared to the development of natural gas and fuel oil prices, the impact on oil prices was determined to be larger. However, it was found that the degree of impact would grow with the change of the relationship from short-term to long-term (Khan, Su and Zhu, 2022). Another event that has shaken the global economy and significantly affected energy prices was Russia’s invasion of Ukraine. The main effect of this war may be a rapid increase in the already high inflation in Europe, which will naturally lead to a slowdown in the economic growth and a reduction in the standards of living of the population. Some of the European

countries have been dependent on Russia for energy, especially in terms of oil and natural gas, which accounted for up to 75 %. It can be expected that as a result of the Russian invasion of Ukraine, there will be several permanent changes in Europe, including strengthening of defence and acceleration of the so-called green transformation, or the transition from fossil fuels to renewables (Astrov et al., 2022).

The objective is to evaluate the development of electricity and natural gas in the last 6 years. To achieve this objective, the following research questions are formulated:

RQ1: How did electricity prices evolve in 2017 – 2022?

RQ2: How did natural gas prices evolve in 2017 – 2022?

RQ3: What was the influence of extreme events on energy prices in the monitored period?

2 Literary research

There is no doubt that extreme events have an impact on the global economy. The effects of these events on energy markets are subject to many studies. For example, Wen, Zhao and Chang (2021) focused their study on the relationship between extreme events and price risk in the energy sector. Using the SVAR model, the analysis of long time span data identified that epidemics have the greatest impact on oil price risk. Also, natural disasters increase the risk of natural gas prices, but on the contrary, the effect of terrorism is not significant. The impact of terrorist attacks on energy prices is also contradicted by another study that focuses on the relationship between geopolitics and energy trade. It uses a regression discontinuity method to simulate a natural experiment and analyses 17 emerging economies based on monthly data and a geopolitical risk index. The results show that wars and conflicts lead to an increase in energy trade (Liu et al. 20221).

Gong, Chen and Lin (2020) focused on oil price fluctuations. Using a time-varying vector autoregression model based on oil prices, they show that shocks caused by major events have a huge impact on oil price volatility and they adversely affect the world economy to a large extent. While periods of elevated oil prices attract a great attention, there is little research into the price of energy in the context of transportation. This research focuses on transport equity issues, including the impacts of fuel prices. Content analysis was used to review publications on the impacts of fuel prices, transport and urban contexts. The paper highlights the need for further studies looking at the interaction between energy, transport and land use and suggests a greater focus on transport equity (Leung et al. 2018)

In the last few years, a high attention has been paid in particular to investigating the impact of the COVID-19 pandemic on commodity market raw material prices trying to estimate their future development. De De Blasis and Petroni (2021) point out the impact of this particular pandemic on all areas of society, with energy markets being no exception. One implication is a reduced predictability of energy price volatility. The method of minute time series analysis is used to study changes in the effects between standard and renewable energies. The model has failed to predict fluctuations during periods of higher volatility during a pandemic while price guidance has been strongly influenced by the phases of virus spread. One of the studies conducted in China also endeavours to estimate price volatility of energy efficiency products during the COVID-19 pandemic, but unit root tests are used to derive the results there. Among energy products, volatility was significant for crude oil, natural oil, and gasoline and diesel oil, for example, due to the interventionist role of green fiscal policies (Yin et al. 2022). Dmytrow, Landmesser, and Bieszk-Stolorz (2021) conclude that commodities such as fuel oil, gasoline, or crude oil are only slightly associated with the COVID-19 pandemic whereas natural gas is strongly affected by the spreading of the pandemic. In this study, a dynamic time warping technique was used to

compare the time series of energy commodity prices with the time series of daily COVID-19 cases to assess the relationship between these positive cases and the energy commodity sector.

The conflict between Ukraine and Russia is causing great concerns and raises many questions about the future of the global economy. Both countries are large exporters of commodities and have a significant impact on food and energy security. Thus, sudden supply disruptions are causing global uncertainty in commodity markets (Ihle et al. 2022). In terms of commodity prices, strong dynamics can be observed recently due to this very ongoing conflict. Using a time-varying parameter vector autoregression method, the effects of this conflict on several markets and commodities such as oil and natural gas are investigated. Not only is high interconnectedness between all markets and commodities found, but changes in commodity markets can be considered the largest since the 2008 financial crisis (Alam et al. 2022).

There is no dispute that the COVID-19 pandemic and the conflict between Russia and Ukraine have affected the energy sector of economies around the world. It was identified from the impact analysis of these events across the energy system that they have caused not only fluctuations in energy demand, but also crude oil price shocks, energy price increases or energy security problems. The impacts of these crises on low-carbon transitions are also gradually observed. These efforts have resulted in political recommendations to implement robust and sustainable energy systems (Zakeri et al. 2022)

Jääskeläinen, Huhta and Syri (2022) studied the trend of electricity prices in Europe, which have climbed to high levels. Concerns about the affordability of energy prices deepened in 2022 when European countries sought to reduce their dependence on Russian fossil fuels due to the Russian invasion of Ukraine. This study based on a combination of legal and qualitative data analysis seeks to show the reasons for the rapid rise in electricity prices by using Finland as an example. The above analysis concludes that high energy prices are generally the result of multiple factors such as weather, economics or politics. The research also shows that the European market design essentially requires price variability to ensure market investment and energy security in the long term. Romania has produced an overview of the electricity sector illustrating the monthly trend in electricity consumption and instantaneous electricity production over the last few years. A quantitative analysis and a linear correlation analysis of market prices in the Eastern European region were used to show the monthly trend of average prices. The results show that electricity markets have experienced significant changes both in terms of prices and behavioural factors. Prices were shown to have fairly similar trends in several countries in the region over the examined period, with price correlations being stronger with higher levels of electricity grid interconnection (Busu, Călin and Mureşan, 2019).

Berrisch and Ziel (2022) studied the natural gas price modeling. This study used daily price data from 2011 to 2020 and an extensive descriptive analysis to develop time series models that capture all the stylized facts of the data. They include the effect of autocorrelation, seasonality, risk premium, temperature, storage levels, European emission allowance prices and the associated oil, coal and electricity prices. The results provide a thorough diagnosis of the model and all its components are interpreted in detail. In addition, future price trends were identified from a probabilistic forecasting study.

In order to reach the goal, content analysis was used to collect data. Subsequently, the descriptive time series analysis method was chosen for data processing to answer research questions 1 and 2 which allows to track the changes of prices over time and understand the trends and fluctuations in the time series. Finally, the method of relational analysis, specifically correlation, was used to answer the third research question.

3 Data and methods

Data

Data on electricity and natural gas prices are taken from the website kurzy.cz (Kurzy.cz, 2023). The average monthly prices of both energy commodities available for the period January 2017 – December 2022 will be used. Furthermore, there will be used data for the period when the Czech economy was influenced by a specific extreme event, an increment in the number of patients with COVID-19, in the period March 2020 – December 2022. The data will be taken from the website Onemocnění aktuálně, an official website of the Ministry of Health of the CR (MZČR, 2020).

All collected secondary data are presented in Appendix 1 and 2.

Methods

Data are processed using Microsoft Excel 2013. Time series of electricity and natural gas price data are processed using descriptive analysis. First, time series are expressed in the form of a graph. The mean value, spread and size of the dataset are described using statistical characteristics, such as the average, median (mean value), variance, and standard deviation, which is calculated by taking the square root of variance.

Next, the trend in the time series is graphically represented using a line (linear trend line) in the graph.

The existence of a statistically significant relationship between the development of energy commodity prices and the COVID-19 pandemic is determined using the correlation analysis. Correlation coefficient calculated using CORREL takes on values between -1 and 1. The value of 1 indicates a direct functional linear dependence between the variables; -1 indicates an indirect functional linear dependence between variables; if the correlation coefficient equals 0, there is no dependence between variables (Stuchlý 2012, p. 29). The next step is to compare the test statistic, which considers the calculated correlation coefficient and the data volume, with the so-called critical value. The critical value is taken from the tables of Student's distribution. The selected significance level is 5 %.

In order to answer RQ3, the following hypothesis is formulated:

H0: Extreme events have impact on electricity and natural gas prices.

H1: Extreme events do not have impact on electricity and natural gas prices.

The application of the selected methods brings the following results:

Graphical representation of electricity price development

Statistical characteristic of electricity price time series

Graphical representation of natural gas prices development

Statistical characteristic of natural gas time series

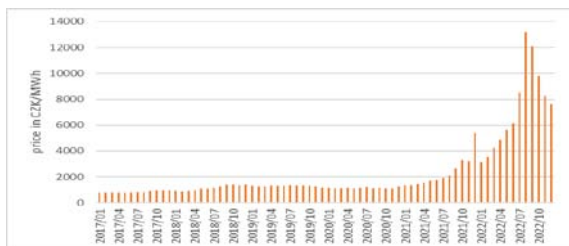
Level of correlation between energy commodity prices and the incidence of cases of COVID-19.

The authors assume that until 2020, electricity and natural gas prices were more or less stable but grew due to the COVID-19 pandemic. It is assumed that a positive correlation will be found between the prices of the above energy commodities and the increments in the number of patients with COVID-19. In the example of this pandemic, it will be demonstrated that extreme events can affect electricity and natural gas prices.

4 Results

Figure 1 shows the development of electricity prices in the monitored period using a bar chart.

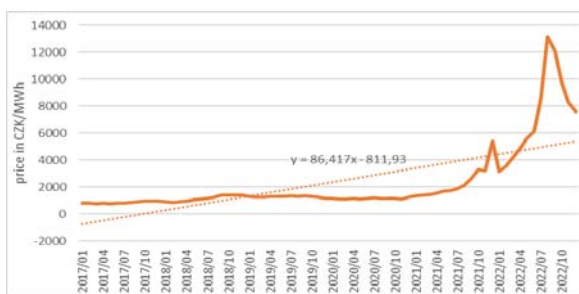
Figure 1 Electricity prices in the years 2017 – 2022



Source: Author.

The minimum values were recorded in May 2017, with the price being CZK 793.77 / 1 MWh, while the maximum values could be seen in August 2022, when the price of 1 MWh was 13 169 CZK. It can be seen from the graph that the values did not differ significantly until 2021, but approximately from the mid-2021, there was an increasingly sharp increase in prices.

Figure 2 Trend of the electricity prices time series

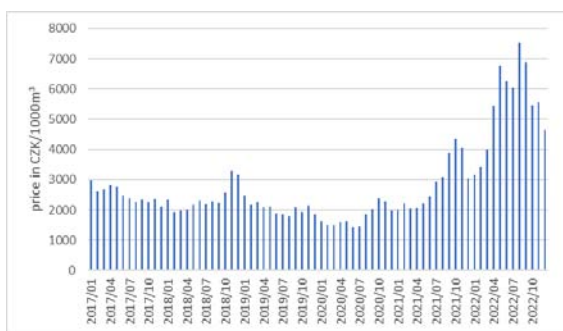


Source: Authors.

The line representing the trend can be expressed with the equation $y = 86.417x - 811.93$. Given the positive slope of the line, it is evident that prices grow over time; however, due to the dispersion of the values from the line, this trend cannot be considered statistically significant.

Figure 3 shows the development of natural gas prices in the monitored period.

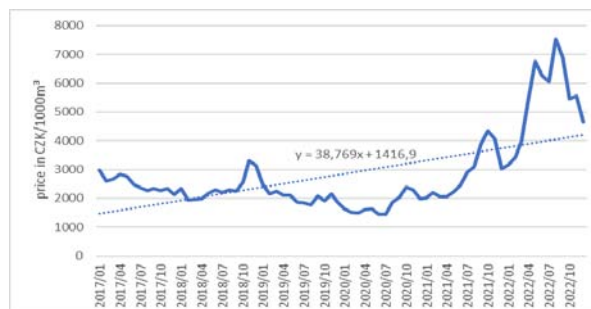
Figure 3 Natural gas



Source: Authors.

The minimum price was recorded in June 2020, specifically 1 436,9 CZK / 1 000 m³. The maximum price was achieved in August 2022 (7 530,5 CZK / 1 000 m³). Compared to electricity prices, natural gas prices show larger fluctuations even before the year 2021 but significant increases did not occur until mid-2021.

Figure 3 Trend in natural gas prices time series in 2017 – 2022



Source: Authors.

The line representing the trend in natural gas prices is expressed in the form of the equation $y = 38.769x + 1416.9$. As in the case of electricity prices, the slope of the line is positive, but the values are rather far from the trend line.

To determine whether there is a relationship between electricity and natural gas prices and the increments in the number of patients with COVID-19, it is necessary to calculate the correlation coefficient, test statistics, and find critical value. The results are presented in Table 3.

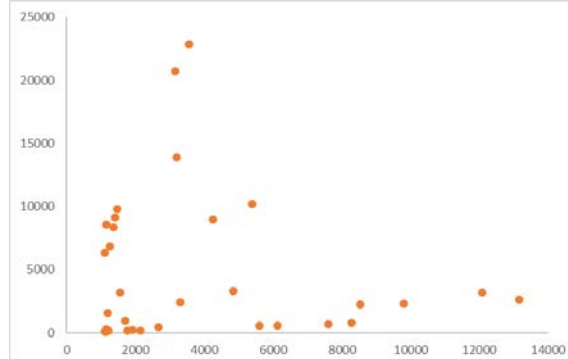
Table 1 Correlation between electricity and natural gas prices

	Electricity, COVID- 19	Natural gas, COVID-19
Correlation coefficient	-0.07435	-0.07362
Test statistics	-0.422	-0.418
Critical value	2.042	2.042

with the increments in the number of patients with COVID-19

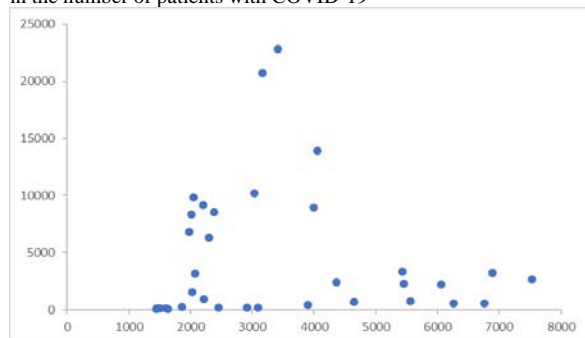
No correlation was confirmed for electricity or natural gas prices and the increments in the number of patients with COVID-19. The negative values of the correlation coefficients were very close to zero, which indicates there is no linear dependence between the monitored variables. The absolute value of the calculated test statistics is significantly lower for both commodities than the critical value at the 5% significance level; statistical significance thus has not been proved. For better clarity, Figures 5 and 6 below show the variance of the monitored values.

Figure 4 Correlation between electricity prices and increment in the number of patients with COVID-19



Source: Authors.

Figure 5 Correlation between natural gas prices and increments in the number of patients with COVID-19



Source: Authors.

The graphical representation of the level of correlation between the energy commodity prices and the positive increments of the number of patients with COVID-19 in the monitored period shows that no dependence between these values can be proven. Therefore, the null hypothesis stating that extreme values have impact on electricity and natural gas prices was thus rejected and the alternative hypothesis was accepted.

5 Discussion

Based on the results obtained, it is possible to answer the research questions:

How did electricity prices evolve in 2017 – 2022?

Between 2017 and 2020, electricity prices in the Czech Republic were more or less stable, ranging on average between approx. 861 CZK/MWh and 1293 CZK/MWh. A more significant growth was recorded in the last two years, especially in 2022, with the average price reaching 7 250 CZK/MWh. The instability of prices in this year is also demonstrated by the value of the standard deviation, which has increased several times compared to the previous year, reaching 3,261 CZK/MWh and thus shows a relatively large dispersion of monthly prices from the average price for this year.

How did natural gas prices evolve in 2017 – 2022?

As for the prices of natural gas, an upward trend can be seen in the monitored period. However, there were larger fluctuations compared to electricity prices. Average prices tended to decrease until 2021 when the average price of 1 000 m³ was 2 686 CZK, which is only a slightly more than in 2017. The highest average price was recorded again in 2022 when it reached 5 508 CZK/1000 m³.

What was the influence of extreme events on energy prices in the monitored period?

The influence of extreme events on electricity and natural gas prices was examined in the example of the COVID-19 pandemic. According to Dmytrow, Landmesser and Bieszk-Stolorz (2021), there is a correlation between the spread of the pandemic and the prices of natural gas, but this does not apply to other energy commodities. In the presented study, no correlation was found between the increments in the number of patients with COVID-19 and electricity or natural gas prices, which means that it was not possible to prove that the price increase was related to the COVID-19 pandemic. To determine the influence of this extreme event, it would probably be necessary to carry out a deeper analysis and include more factors that might have influenced the prices of energy commodities in relation to the pandemic.

6 Conclusion

The objective of the paper was to evaluate the development of electricity and natural gas prices in the Czech Republic in the last 6 years and to determine whether extreme events have an impact on the prices of these energy commodities. The objective of the paper was achieved. It was found that electricity prices

were more stable in the monitored period compared to natural gas prices. The comparison of the graphical illustration of the prices' development showed that the natural gas prices show larger fluctuations. However, the prices of both commodities recorded a significant growth approximately in mid-2021; the maximum values were achieved in August 2022.

For the purposes of demonstrating the dependence of these energy commodity prices on a specific extreme event, represented by the COVID-19 pandemic, the correlation method was used. However, the values of the correlation coefficients were negative and very close to zero, which means that the assumption that the average increments in the number of patients with COVID-19 is related to the development of energy commodity prices could not be confirmed. If we wanted to prove this, a more complex analysis, such as a regression model, would be necessary, which would include other factors – measures introduced by the state (closures of schools or businesses, restrictions on mobility) in connection with energy consumption during this period, or economic factors, such as the development of GDP during the pandemic.

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Primary Paper Section: B

Secondary Paper Section: BB

D EARTH SCIENCES

DA	HYDROLOGY AND LIMNOLOGY
DB	GEOLOGY AND MINERALOGY
DC	SEISMOLOGY, VOLCANOLOGY AND EARTH STRUCTURE
DD	GEOCHEMISTRY
DE	EARTH MAGNETISM, GEODESY, GEOGRAPHY
DF	PEDOLOGY
DG	ATMOSPHERIC SCIENCES, METEOROLOGY
DH	MINING INDUSTRY INCLUDING COAL MINING AND PROCESSING
DI	POLLUTION AND AIR CONTROL
DJ	POLLUTION AND WATER CONTROL
DK	CONTAMINATION AND DECONTAMINATION OF SOIL INCLUDING PESTICIDES
DL	NUCLEAR WASTE, RADIOACTIVE POLLUTION AND CONTROL
DM	SOLID WASTE AND ITS CONTROL, RECYCLING
DN	ENVIRONMENTAL IMPACT ON HEALTH
DO	PROTECTION OF LANDSCAPE

THE KEY FACTORS IN SEA TOURISM PLANNING IN TERMS OF SEAWATER ATTRACTIVENESS FOR HUMANS' HEALTH AND COMFORT

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Abstract: Summer visits to coastal sea destinations are the most represented in world tourism, accounting for 55% of global tourist travel. A seaside vacation is a form of relaxation and recreation with numerous benefits for a person's psychological, physical, and mental health. Sea water and air rich in marine minerals have a profound effect on the human psyche and provide a pleasant holiday in relation to oceanographic motifs as the main tourist attractions during the summer season. This paper explores the key tourism attributes of seawater from the perspectives of sea recreational tourism and humans' health and comfort. Chemical composition, temperature, salinity, dynamics, and water purity have been identified as major attractiveness factors (elements) for planning healthy sea activities and the swimming tourist season at coastal destinations. It was found that tropical and subtropical coastal regions are mostly touristically significant, while coastal desert regions are gaining significant popularity. The study's findings are educational and applicable to the tourist valorisation and tourism planning of the seas, as well as for understanding the new trends in global sea tourism.

Keywords: seawater attractiveness, chemical content, temperature, salinity, dynamics, purity, sea tourism, valorisation, planning.

1 Introduction

During the summer season, visits to coastal sea destinations are the most popular, accounting for 55% of global tourist travels. They are related to the category "Leisure, recreation, and holidays" (UNWTO, 2021), which, with the indicated percentage participation, is the most represented in world tourism. More precisely, „coastal and marine tourism represents approximately 50 percentage of total global tourism which includes tourism infrastructure, impact, visitation, and spending. It constitutes the largest economic sector for most small island developing states and many coastal states. Current projections estimate by 2030, coastal and marine tourism will represent the largest ocean economy sector, employing approximately 8.5 million people“ (Ocean Panel). A seaside vacation is not only a form of relaxation and recreation, but it also has numerous benefits for a person's psychological, physical, and mental health. Sea water and air rich in marine minerals have a profound effect on the human psyche and provide a pleasant holiday in relation to hydrographical-oceanographic motifs as the main tourist attractions, particularly during warmer seasons.

Oceans cover 71% of the Earth's surface, with continents and islands accounting for the remaining 29%. The ocean contains 97% of the world's water. The small portion that isn't in the oceans accounts for just around 2% of the frozen water trapped in the glaciers and ice caps. All of this water is not uniformly distributed on Earth; oceans cover 61% of the Northern Hemisphere, while they cover 81% of the Southern Hemisphere.

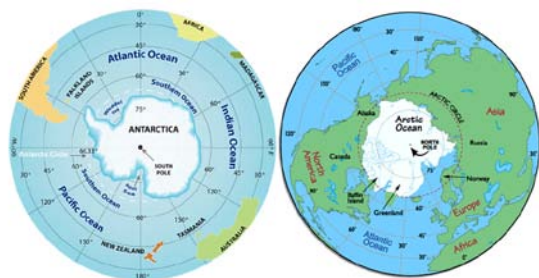


Fig. 1. Water and land distribution in the Northern and Southern Hemispheres
(Author adopted according to the World Atlas, 2018 and WordPress of the Place and Things Portal, 2014)

Water and land distribution maps demonstrate an imbalance in representation on the Earth's surface, with a much greater

presence of water in the Southern Hemisphere. There are five world oceans: the Atlantic, Pacific, Indian, Southern, and Arctic. The first three are situated in both hemispheres, while the Southern Ocean is located in the Southern Hemisphere and the Arctic is found in the Northern Hemisphere.

Table 1. An overview of the world's oceans and waters

	Percentage of Earth's water in various locations	Area (million km ²)	Average depth (m)
Pacific ocean	52	166	4282
Atlantic ocean	25	87	3926
Indian ocean	20	73	3963
Arctic ocean	/	14	1205
Antarctic/ Southern ocean	/	20	4000
Ice	2		
Ground water	0,6		
Atmosphere, lakes and rivers	0,01		

(Roger Williams University)

Seas are subsets of the ocean. „Sea is the salt water that covers most of the earth's surface and surrounds its continents and islands“ (Oxford). According to Stanković (2000), seas are classified according to their location in respect to the oceans and the surrounding land:

- Mediterranean: they are surrounded by land on almost all sides and are connected to the oceans by straits and canals, e.g., the Mediterranean Sea;
- Marginal: they are located along the continents for a considerable length of their coasts and are separated from the ocean by an archipelago, for example, the Sea of Japan;
- Interisland: seas between larger and smaller islands and archipelagos, e.g., the Java Sea.

Bays, fjords (submerged glacier valleys), rias/estuaries (submerged river estuaries), lagoons (areas, bays or pools of sea water isolated from the sea by a sand bar or rock reef), and others are smaller sections of the sea.

The following factors are critical for the tourist valorisation of seas and oceans: chemical composition of water, temperature, salinity, water dynamics, and purity (quality).

2 Methodology

This paper investigates the key factors in sea tourism planning in terms of seawater attractiveness. Seawater attractiveness is mostly referred to as the seawater quality, which is critical for planning healthy activities related to the sea environment. The aim is to determine the basic tourism & geographical attributive factors of the salt waters from the perspective of planning bathing-recreational tourism and from the standpoint of its impact on humans' health and comfort. The most significant sea and oceanographic elements and their corresponding attributes for the requirements of seaside tourism activities such as bathing, swimming, therapy, rehabilitation, and relaxation have been identified in the paper, accounting them responsible enabling comfort as “a state of physical ease and freedom from pain or constrain”, “things that contribute to physical ease and well-being” (Oxford). Modern referent models for determining the attributive features of saltwater are presented, including chemical composition, temperature, salinity, dynamics, and purity. They play a crucial role in determining the summer bathing and recreational tourist seasons in coastal regions worldwide. For this study, both primary and secondary sources were used, including informal interviews and the author's observations at the visited coastal destinations. Secondary sources included an extensive repository of relevant literature, data, and statistics from international astronomy, tourism, and environmental protection organisations. The research has a fundamentally & applicative character since it educates about the importance of oceanographic components in tourism valorisation, while also providing standardised criteria for their application in tourism planning. The

paper also explores examples of coastal destinations based on their leading seawater attractiveness and their significant role in global sea tourism, as additionally demonstrated through the selected comparatively analysed examples.

3 Research Results

3.1 The chemical composition of seawater and its benefits for human health

„Seawater is a complex ionised solution that comprises sodium, magnesium, calcium, and potassium cations, as well as anions of phosphorus, iodine, bromine, and some nitrogenous substances. Seawater contains biogenic stimulators for the human body. Swimming in the sea is thus far more advantageous than swimming in freshwater lakes and rivers“ (Stanković, 2000).

Table 2. Chemical composition of seawater (*salinity S = 35.000*)

Major Constituents	(mmol/kg)	Trace Constituents	(mmol/kg)
Na ⁺	469.0	Al	-0.03
K ⁺	10.21	Fe	-1 x 10 ⁻³
Mg ²⁺	52.83	Co	-3 x 10 ⁻⁵
Ca ²⁺	10.28	Ni	-8 x 10 ⁻³
Sr ²⁺	0.091	Cu	-4 x 10 ⁻³
Cl ⁻	545.9	Zn	-6 x 10 ⁻³
SO ₄ ²⁻	28.23		
HCO ₃ ⁻	2.06		
Br	130		

(Author adopted according to the Science and Issues: Water Encyclopedia)

Table 3. Comparison of river water and sea water composition

Ions	Average river water (mM/l)	Average sea water (mM/l)	River water ratio to Cl	Sea water ratio to Cl
HCO ₃ ⁻	0.86	2.38	5.375	0.0044
SO ₄ ⁻	0.069	28.2	0.43125	0.0517
Cl ⁻	0.16	545	1	1
Ca ²⁺	0.33	10.2	2.0625	0.0187
Mg ²⁺	0.15	53.2	0.9375	0.09761
Na ⁺	0.23	468	1.4375	0.8587
K ⁺	0.03	10.2	0.1875	0.0187

(Author adopted according to the Science and Issues: Water Encyclopedia)

Bathing in sea water, swimming, and diving, along with a pleasant climate and healthy sea AQI, provide various health benefits:

- it has a sedative and energising impact since it provides the body with the essential ions and energy;
- improves musculature, motor skills, and general physical condition by increasing muscle tone;
- strengthens the heart and respiratory system by regulating breathing and increasing CO₂ excretion;
- relieves stress, lowers blood pressure and glucose, and enhances a good mood;
- stimulates circulation due to the stimulating effect of thermal changes when entering the water (chills) and adaptation to the saltwater environment (pleasure);
- it burns calories and cholesterol and contributes to weight loss by accelerating biogenesis and mitochondrial function;
- prevents ulcers and malignant disorders while additionally encouraging cell renewal;
- decreases symptoms and heals inflammatory skin problems (eczema, for example) because it lessens the severity of symptoms in skin lesions and balances particular minerals in the body;
- reduces the growth of *H. pylori* and other bacteria, improving antibacterial activity;
- treats osteoporosis and enhances mobility by stimulating cell proliferation, bone mineralization, spine stretching, and joint relief;
- purifies the liver and kidneys by lowering serum levels of AST and ALT, TC and TG, decreasing lipid accumulation, and inhibiting the development of toxic processes;
- reduces physical fatigue and weakness by improving the sustainable amount of lactic acid and decreasing glycogen in the liver.
- boosts immunity and promotes restful sleep.

According to Mohd Nani et al. (2016), deep sea water is beneficial to health as it usually comes with no bacteria activities, low temperature, high purity, and it's rich in nutrients and numerous minerals, which include magnesium (Mg), calcium (Ca), potassium (K), chromium (Cr), selenium (Se), zinc (Zn), and vanadium (V). Deep sea water can help overcome health problems especially related to lifestyle-associated diseases such as cardiovascular disease, diabetes, obesity, cancer, and skin problems.

Table 4. Extract from the Mohd Nani et al. comparative table of amount of top elements in the surface seawater and deep sea water

Type of element	Surface sea water (mg/L)	Deep sea water (mg/L)
K	392	10400
Mg	1290	96100
B	4.45	320
Br	67.3	5400

(Author)

According to the comparative table of amount of elements in the surface seawater and deep sea water (Mohd Nani et al., 2016), deep seawater is significantly richer in certain minerals, especially in K, Mg, B, Br, etc., whose concentration far exceeds the presence in the surface water. "Boron plays an important role in osteogenesis, and its deficiency has been shown to adversely impact bone development and regeneration. Boron influences the production and activity of steroid hormones, actions via which this trace mineral is involved in the prevention of calcium loss and bone demineralization" (Pizzorno, 2015). "Potassium is necessary for the normal functioning of all cells. It regulates the heartbeat, ensures proper function of the muscles and nerves, and is vital for synthesizing protein and metabolizing carbohydrates" (Harvard Health Publishing, 2019). "Magnesium is a nutrient that the body needs to stay healthy. Magnesium is important for many processes in the body, including regulating muscle and nerve function, blood sugar levels, and blood pressure and making protein, bone, and DNA" (National Institutes of Health, 2023). "Bromine is an essential trace element for assembly of collagen IV scaffolds in tissue development and architecture" (McCall et al., 2014). Therefore, diving and snorkelling present healthy activities. According to Carreno et al. (2020), there are significant beneficial effects of short-term exposure to scuba diving on human mental health. Exposure to outdoor blue spaces can help improve human health by reducing stress, promoting social relationships, and physical activity. Both, beach and scuba diving activities have positive effects for human mental health, particularly among subjects with regular medication intake. Subjects with regular medication intake due to a chronic or psychiatric illness have a POMS (Profile of Mood State) reduction score significantly higher than other subjects. Diving in small groups, with a diving instructor, and after receiving a complete briefing is expected to have significantly less environmental impact. Therefore, a strategy that balances both the health of the scuba divers and the health of the environment must be promoted in order to enhance diver's health and preserve the marine environment.

3.2 Sea water temperature

According to NOAA, the ideal temperature range for swimming is 21.1-25.6° C, which is known as the swimming comfort grade. According to the Columbia Association, cooler water is better suited for higher-intensity activity, while warm water is more therapeutic for the older population or babies and toddlers learning to swim.

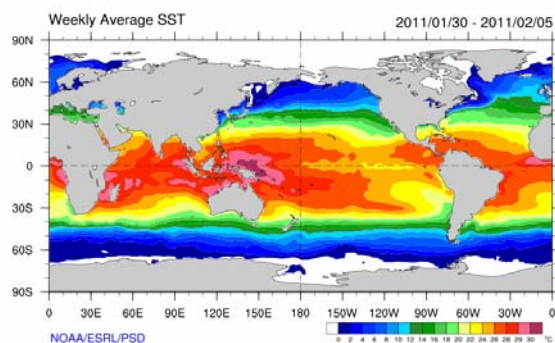


Fig.2. Ocean water temperatures (NOAA, Andedge)

According to the map (fig.2), a three-layer system of temperatures from the surface to the bottom of the ocean has been determined:

- 1) The upper (first) layer consists of warm ocean water with a density of around 500 m and temperatures ranging from 20 to 25 degrees Celsius. It is found across the tropical region and also in the mid-latitudes during the summer season;
- 2) The thermocline- the second layer (below the first), has a dramatic drop in temperature with increasing depth and a thickness of 500-1000 m.;
- 3) The bottom (third) layer is extremely cold and extends along the entire deep ocean floor. The temperature of the ocean water surface is near 0°C in the Arctic and Antarctic Circles, and the thermal oscillation with depth is quite minimal because there is just one layer of cold water that spans from the surface to the deep ocean floor.

As a result, the ocean warms in the tropics while cooling in the high latitudes. The average temperature of surface ocean water is 27 °C, and it decreases gradually from the equator to the poles. The average temperature of ocean water is about 22 degrees Celsius at latitude 20 degrees Celsius, 14 degrees Celsius at latitude 40 degrees Celsius, and 0 degrees Celsius at the poles. The highest temperature was recorded north of the equator (instead of on the equator); the average annual temperature in the Northern Hemisphere is 19 degrees Celsius and 16 degrees Celsius in the Southern Hemisphere. For a demonstrative comparison, for instance, the Red Sea's average water temperature is 22–30 degrees Celsius, or exceptionally 15–45 degrees (Gulf of Aqaba), compared to the Mediterranean Sea's average water temperature of 18.3-27.2 degrees Celsius.

For the beginning of the tourist swimming and bathing season, a water temperature of 22 degrees Celsius and an air temperature of 18 degrees Celsius are recommended. The tropical and subtropical seas have the highest tourism value since they have plenty of solar radiation and a mild climate, and they are the warmest seas with the most popular swimming destinations worldwide. The swimming season is the longest towards the tropic of Cancer, where the desert reaches the sea (for example, the Red Sea, latitude 16N–28N). Bathing season in subtropical areas (such as the Mediterranean) lasts 3–4 months on average (June–September), 5 months (May through September) in tropical areas (such as Hawaii), and 8 months (April–November) in the warmest and world's most arid areas (such as the Red Sea). Because the bathing season is the longest on the coastlines of Egypt, the UAE, and other similarly situated countries, the Red Sea region's tourism is significantly growing; aside from the favourable climate, the Red Sea is incredibly clean and rich in corals, and a desirable feature is the tame dynamics of sea water; for example, the Hurghada Sea is exceptionally calm, with no high waves, and has a unique tide that literally pushes the water evenly towards the shore, making swimming easier. „The Red Sea is a narrow elongated water body extending some 2,000 km SE–NW, between latitudes 16°N and 28°N, from the Gulf of Aden through which it connects from the Gulf of Aden (through which it connects to the Indian Ocean) to the Gulf of Aqaba

(Figure 1). It is flanked by east Africa (Egypt, Sudan, Eritrea, and Djibuti) to the west and Arabia (Saudi Arabia and Yemen) to the east. The Red Sea hosts spectacular coral reefs that pertain to the Indo-Pacific domain. Its northern tributaries, the Gulfs of Suez and Aqaba (reaching latitude 29.5°N) are home to some of the northernmost coral reefs in the world“ (Shaked & Genin, 2011).



Fig.3. The Red Sea, Hurghada, Egypt- crystal clear water (Author's Private Collection)

According to Hawkins and Roberts (1994), there's an expansive growth of coastal tourism in the Red Sea (primarily Egypt, Israel, and Jordan) motivated by warm water and coral reefs, among other attractions. Rapid and large-scale tourist development since the 1970s has resulted in numerous resorts in the coastal area: tourism and diving play a central role in Hurghada's economy, while Sharm-el-Sheikh has expanded into a major international resort; much of Israel's coastline has been rapidly built up to accommodate recreation, port facilities, and housing; and Jordan, due to the increasing tourist visits, is doubling its tourism capacities. According to Colby (2003), the Sinai and Red Sea governorates received roughly 2.5 million foreign tourists (plus 670,000 Egyptians), staying for about 20 million tourist nights in 2000, up from practically zero in 1980. The Red Sea region's coastal tourism development plans are often seen as the most ambitious in the world. "Tourism in the Red Sea region is gaining momentum, with occupancy rates of 80% and rising" (Ahrām). According to the Egypt Independent (2023), resorts and hotels in the Red Sea governorate received more than four million tourists of different nationalities in 2022, mostly German, Russian, Czech, and others. According to the Civil Aviation Authority and the Red Sea Governorate, there's an average of about 1.35 million foreign plus 200,000 Egyptian visitors per year. Surveys suggest that 30-50% of the total visitors are divers, averaging 3-5 days of diving each, while about 25% are snorkelers for at least one or two days. This translates to a range of 1.0-3.5 million diving and snorkelling days, and 1.6 – 4.1 million days, followed with range of \$3.8-10.3 million per year in potential combined revenues (Colby, 2003).

3.3 Salinity of sea water

"The two most common elements in sea water, after oxygen and hydrogen, are sodium and chloride. Sodium and chloride combine to form what we know as table salt" (NOAA). Salinity is important for its therapeutic chemical composition as well as enhancing the density of water. Swimming becomes simpler because saltier water is heavier, providing better support to the swimmer's body than freshwater. "In sea water, there is typically close to 35 grams of dissolved salts in each liter (35ppt), but ranges between 33-37 grams per liter (33ppt - 37ppt). But as in weather, where there are areas of high and low pressure, the ocean has areas of high and low salinity" (NOAA). According to some sources, increased salinity generates a more pronounced blue pigment and higher clarity of the water; however, this is more dependent on other important factors such as sunlight absorption and scattering of light, mineral composition, depth,

organic matter and phytoplankton, etc. The chemical composition of water is highly related to salinity, which has numerous beneficial impacts on human health and other organisms (as previously mentioned).

According to the CATDS Ocean Salinity Expert Center, global salinity patterns are linked to rainfall and evaporation. Salinity affects seawater density, which in turn governs ocean circulation and climate. The higher salinity of the Atlantic sustains the oceanic deep overturning circulation. Salinity variations are driven by precipitation, evaporation, runoff and ice freezing and melting.

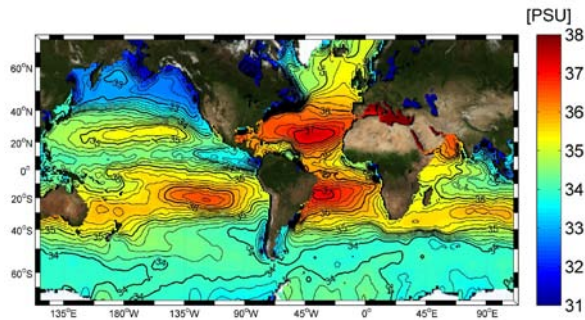


Fig.4. Annual mean of the sea surface salinity distribution (CATDS retrieved from World Ocean Atlas, 2005)

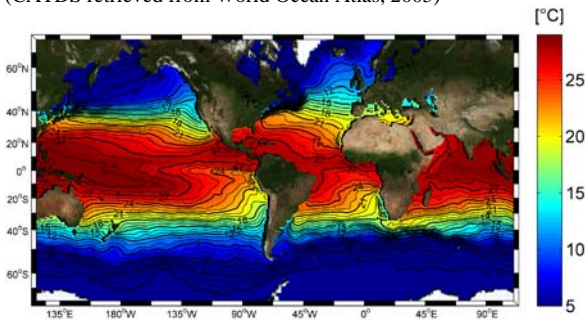


Fig.5. Global sea surface temperature (CATDS Ocean Salinity Expert Center)

This is mainly because the surface sources of variability for temperature are different than for salinity: the ocean is indeed heated up in the tropics and cooled at high latitudes while salinity is dominantly modified by concentration-dilution related to the evaporation-precipitation- river runoff flux (E-P-R).

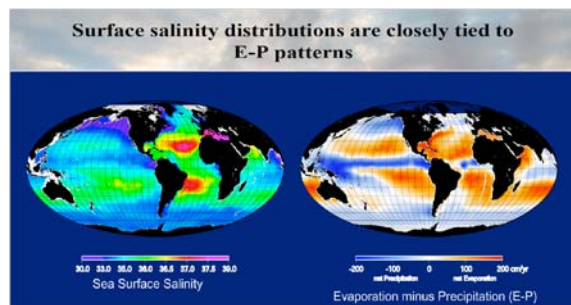


Fig.6. Salinity Distribution at the Ocean Surface- Sea Surface Salinity- Remote Sensing (CATDS Ocean Salinity Expert Center)

Surface salinity distributions are closely tied to evaporation and precipitation patterns. If it rains more than evaporated ($E < P$), for example in area of strong atmospheric convection (e.g., equatorial) or at moderate latitudes, the salinity diminishes at the ocean surface. In subtropical zones, evaporation dominates over precipitation ($E > P$) and salinity increases.

The Red Sea is a relevant example of a tourist-friendly sea with a highly saline water; the Egyptian coast of Hurghada, a popular seaside and safari tourist destination, has a desert climate (Bwh according to Köpen's climate classification), with an average annual air temperature of 24.4 degrees Celsius and an average precipitation of only 6 mm per year, which resulted in a high salinity of about 40–42 psu.

3.4 Ocean Movements (Seawater Dynamics)

“Dynamic ocean explains the movement of water and energy in the oceans” (Stow, 2017). “Ocean water moves in two directions: horizontally and vertically. Horizontal movements are referred to as currents, while vertical changes are called upwellings or downwellings. This abiotic system is responsible for the transfer of heat, variations in biodiversity, and Earth's climate system” (National Geographic Society). “The vertical motion refers to tides. Ocean currents are the continuous flow of huge amount of water in a definite direction while the waves are the horizontal motion of water. Water moves ahead from one place to another through ocean currents while the water in the waves does not move, but the wave trains move ahead” (National Council of Educational Research and Training). “The movement of ocean water is a complex and dynamic process driven by various factors, including wind, temperature, salinity, the Earth's rotation, and the geography of the ocean basins. Ocean currents, tides, and waves are the primary manifestations of ocean water movement” (ClerIAS, 2023).

- *Currents.* “The pattern of circulation results from a more complex interaction of wind drag, pressure gradients, and Coriolis deflection resulting in gyres, loops, and eddies. Slow-moving currents in the deep ocean basins transfer energy, nutrients, and sediments around the world. These currents are driven by density differences linked to water temperature and salinity and are part of the global thermohaline circulation system” (Stow, 2017). Warm ocean currents increase the temperature of the sea, land, and air, especially during the winter season, which results in a milder climate in coastal areas than in inner land. Furthermore, the direction and speed of currents are key factors in planning navigational profiles (nautics), cruise lines, port sites, and wastewater discharges, among other things;
- *Waves.* “Almost all surface waves are generated by wind stress with the three stages in wave development known as sea, swell, and surf” (Stow, 2017). Extreme water sports like surfing in the oceans of California, Hawaii, the Philippines, Indonesia, Australia, etc. can benefit from higher waves. In the context of natural thalassotherapy, waves with a height under 0.5 m have a stimulating effect on sea bathers; smaller waves may be generally preferred for restful swimming. Despite being associated with wind, waves are also influenced by geotectonics; for example, in seismically active seas, the beaches along the Ring of Fire (Circum-Pacific Belt) have the greatest waves in the world.
- *Tides* are created by the gravitational pull of the Moon and the Sun and by a centrifugal force due to the rotation of the Earth (Stow, 2017). Sea tides are crucial for determining the location of tourist attractions and supporting infrastructure along the shore, as well as for controlling navigation and anchoring, respecting their importance to all creatures of the sea, and preventing negative effects on the environment.

3.5 Marine water quality/ Seawater purity

“Marine water quality refers to the presence or absence of any number of pollutants in ocean waters. Some of the more important pollutants include oil, sedimentation, sewage, nutrients, heavy metals, and thermal pollution. Water quality monitoring relies on taking a suite of measurements of ocean water” (Encyclopedia). For sea water to be valued as a tourist attraction, it's required to be clean and safe for humans' health. Remote sensing and specific techniques are used to measure, monitor, and assess the sea water's quality:

- CDOM/FDOM monitoring (dissolved organic matter in water body; concentrations of CDOM affect submerged aquatic vegetation, coral reefs and other benthic communities; fDOM apps. include continuous monitoring of wastewater discharge)
- Chlorophyll fluorescence analysis (algae flourishing in water)
- Conductivity (EC/ electrical conductance), salinity, and TDS (total dissolved solids) monitoring (measuring the specific electrical conductance of electrolytes dissolved in the water, for example, possible ranges are EC 51,500 $\mu\text{s}/\text{cm}$ and TDS 35,000 mg/L, with the TDS tolerance threshold for humans being 0-500 mg/L)
- Recording the water temperature (which is related to the rate of photosynthesis and metabolism, the dissolved gas concentrations, the conductivity and salinity, the pH, and the water density, etc.)
- Measuring the dissolved oxygen levels (the percent saturation or mg/L oxygen available to the flora and fauna, for instance, the optimal rank is 90–100% for marine ecosystems, and if it is above or below the specified rank, the water will become increasingly polluted; or, a dissolved oxygen level of less than 6 mg/L can be harmful to the ecosystem of water bodies)
- pH and KH testing (increasing pH and carbonate hardness are hazardous to aquatic ecosystems; for example, the optimal pH range for oceanic living species is 8 to 9)
- Assessing the turbidity, TSS (total suspended solids) and clarity (a nephelometer measures the total amount of suspended solids and heavy metals in mg/L; e.g., a desirable category of turbidity would be ≤ 10 , while high turbidity is typically a sign of low water quality; additionally, the water that is crystal clear is not necessarily healthy as it can indicate very acidic conditions or a very high level of salinity)

Standard assessments and evaluations based on the presence of enterococci and E. coli bacteria in the water are crucial for the monitoring of sea water, which is a requirement for the sanitary-hygienic suitability of the water for swimming:




	Excellent Water Quality: Indicates this sample meets the following standard: less than or equal to 250 Escherichia coli per 100ml less than or equal to 100 Intestinal enterococci per 100ml
	Good Water Quality: Indicates this sample meets the following standard: less than or equal to 500 Escherichia coli per 100ml less than or equal to 200 Intestinal enterococci per 100ml
	Poor water Indicates values are above 500 Escherichia coli per 100ml and above 200 Intestinal enterococci per 100ml

Fig.7. Sea water monitoring (Government of Jersey)

As a result of their location in the southern hemisphere, which is less inhabited than the northern one and has reduced ship traffic, the South Pacific and South Atlantic are the oceans with the cleanest water. The waters surrounding the Earth's poles are also addressed in certain publications, with the assertion that the Antarctic waters (in the south) are cleaner than the Arctic waters (in the north); nonetheless, the polar seas do not have so considerable tourist relevance.

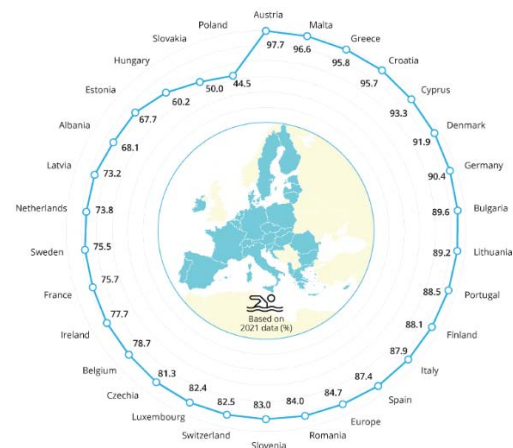


Fig.8. Inland and coastal bathing waters with excellent quality in European countries in 2021 (EEA, 2022)

According to the figure above, in four countries, 95% or more of bathing waters were of excellent quality: Austria, Malta, Croatia and Greece. Additionally in Malta, Bulgaria, Romania and Luxembourg, all assessed bathing water sites were of at least sufficient quality. “In the period 2015-2021, the share of bathing waters having an excellent status in Europe has been stable at 85-88% for coastal bathing waters; and at 77-82% for inland bathing waters. The quality of coastal sites is generally better than that of inland sites due to the higher self-purification capacity of coastal areas. Moreover, many central European inland bathing water sites are situated on relatively small lakes and ponds as well as rivers with a low flow, which, especially in the summer, are more susceptible than coastal areas to short-term pollution caused by heavy summer rains or droughts” (EEA, 2021). Among the cleanest seas in Europe, Cyprus stands out, having received perfect points of 100% for excellent water quality at as many as 112 swimming locations around the island (Žunić, 2022).

At the global level, the Red Sea is reportedly one of the cleanest tourist waters in the world according to many tourism sources, including UNEP and others. Despite human use and recreational development, Fahmy et al.'s (2016) evaluation study of the Egyptian Red Sea coastal water quality confirmed preserved water with a limited and imperceptible impact of tourist activities.

4 Conclusion

The largest hydrographic tourist attractions are the oceans and seas, which attract visitors from all over the world to take advantage of their fascinating features and countless health benefits. The advantages of sea water are immeasurable, especially for the tourism industry, as for example, according to the IUCN, tourism represents 92% of the economic value of sea-related activities in the Mediterranean (Žunić, 2022). Both the chemical and physical characteristics of saltwater, as well as its dynamics, constitute essential oceanographic factors for the purposes of tourist planning, valuation, and exploitation. These factors are evaluated in accordance with the potential to implement various human activities (bathing, swimming, extreme sports, sailing, etc.). Tropical and subtropical seas are the most attractive and most visited by tourists, for example: “International tourist arrivals (overnight visitors) to destination countries in the Mediterranean reached a record 342 million in 2014, nearly one-third of total arrivals worldwide (1,133 million). Considered as a single area, the Mediterranean is by far the world's largest tourism destination” (UNWTO, 2015). The subtropical climate of the Mediterranean region has a significant role in drawing tourists there. Besides pleasant temperatures, the Mediterranean has been inhabited since the early Neolithic era due to its prime position and advantageous living circumstances,

which also resulted in the Mediterranean taking pride in having a rich culture and many other tourist attractions. "The Mediterranean Basin has been the cradle of world civilization since the first settlements in Jericho in 9000 BC" (Saglam, 2013). In terms of the cleanest seas in Europe, Cyprus tops the list. However, the Egyptian Red Sea has remarkable water quality due to its desert location. In contrast to summer humidity (>°C and >RH%), which is growing throughout the Mediterranean region as a result of climate change, the high temperatures and low humidity of Hurghada, for instance, are far more comfortable. Solimene, Brugnoli, and Minelli (2002) stated that climate discomfort index is determined by the relationship between temperature and relative air humidity; for instance, a temperature of 30 degrees Celsius is comfortable with an air humidity of 30%, unpleasant with an air humidity of 50%, and unbearable with an air humidity of over 70%. For demonstrative comparison, in Hurghada (a desert coastal Red Sea tourism destination), during the summer busiest season (June, July, and August), the air temperature ranges from 31 to 33 degrees Celsius, followed by a lower relative humidity of 41–45%, while, for instance, in Malta (a Mediterranean sea tourism destination), the temperature ranges from 29 to 32 degrees, followed by a high relative humidity of 69–78%. Such climate specifications, including the higher seawater temperature and the longer sea tourism seasonality, promote desert coastal destinations as more attractive than the Mediterranean, not only in terms of climate comfort and humans' health but also from the perspective of their rising popularity in global sea tourism.

Finally, based on the findings of this research, a summary table of the key maritime contributing factors, or indicators of attractiveness, in terms of planning fundamental and healthy tourism activities is created:

Table 5. Top indicators of seawater attractiveness for planning basic and healthy tourism activities

Category	Description	Benefits
Chemical composition	Highly mineralised: Cl, Na, Br, Mg, SO ₄ , K, Ca, etc.	Improving health of humans' skin, and organism systems: muscular, skeletal, nervous, respiratory, circulatory, etc.
Temperature	Moderate: 21.1-25.6°C	Swimming comfort grade
Salinity	Highly saline water: 33-40 g/l (ppt/psu)	Swimming simplicity
Sea dynamics	Currents: warm, cool; waves: short, high; tides: low, high	Affecting tourism & hospitality infrastructure building, ports & sea navigation, higher-intensity tourist activities or therapeutic effects
Sea water purity	Permitted bacteria per 100 ml water: ≤250-500 E. Coli; ≤100-200 I. Enterococci	Good to excellent water quality for swimming

(Author)

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Primary Paper Section: D

Secondary Paper Section: AK, AQ, DG, DD, DJ

F MEDICAL SCIENCES

FA	CARDIOVASCULAR DISEASES INCLUDING CARDIO-SURGERY
FB	ENDOCRINOLOGY, DIABETOLOGY, METABOLISM, NUTRITION
FC	PNEUMOLOGY
FD	ONCOLOGY AND HAEMATOLOGY
FE	OTHER FIELDS OF INTERNAL MEDICINE
FF	ENT (IE. EAR, NOSE, THROAT), OPHTHALMOLOGY, DENTISTRY
FG	PAEDIATRICS
FH	NEUROLOGY, NEURO-SURGERY, NUERO-SCIENCES
FI	TRAUMATOLOGY AND ORTHOPAEDICS
FJ	SURGERY INCLUDING TRANSPLANTOLOGY
FK	GYNAECOLOGY AND OBSTETRICS
FL	PSYCHIATRY, SEXOLOGY
FM	HYGIENE
FN	EPIDEMIOLOGY, INFECTION DISEASES AND CLINICAL IMMUNOLOGY
FO	DERMATOLOGY AND VENEREOLOGY
FP	OTHER MEDICAL FIELDS
FQ	PUBLIC HEALTH SYSTEM, SOCIAL MEDICINE
FR	PHARMACOLOGY AND APOTHECARY CHEMISTRY
FS	MEDICAL FACILITIES, APPARATUS AND EQUIPMENT

VALIDATION PROCESSES OF INTERVENTIONS FOR THE NURSING DIAGNOSIS – RISK FOR INFECTION (CODE 00004) IN CLINICAL PRACTICE IN CZECH AND SLOVAK REPUBLICS

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Kega project 022UKF-4/2020 entitled Implementation of Nursing Interventions into Multimedia Technologies in Nursing Education.

Abstract: The purpose of the study was to determine which NANDA nursing diagnosis are made and which related NIC nursing interventions are carried out most frequently by clinical nursing experts. Methods: The Likert Scale and Fehring's Diagnostic Content Validity Model (DCV model) were used for the research. Sample: The total number of all participants of the validation research, i.e. academic nurses/experts, and clinical nurses/experts ($n_c=848$) from 2 countries – SR and CR, consisted of 4 subsamples. A total of 69 items – activities of two interventions for NIC nursing diagnosis: Risk for Infection 00004 were evaluated. Results: We found out that the total set of experts rated all activities/practices of Intervention I and II as significant. Conclusion: The results of the international study provide valid findings for the development of nursing care and curriculum for future professionals.

Keywords: NIC. NANDA. Clinical Nursing. Expert. Validation.

1 Introduction

The presented scientific study builds on the empirical outputs published by the universities in two countries in the field of nursing diagnostics and nursing interventions, i.e. the Faculty of Social Sciences and Health Care, the University of Constantine the Philosopher in Nitra in collaboration with the Faculty of Health Care Studies, the University of West Bohemia, Faculty of Health Care, the University of Presov and their clinical departments. First with the support of the Kega project entitled *Implementation of Nursing Interventions into Multimedia Technologies in Nursing Education* and now with the support of the follow-up Kega project entitled *Implementation of Nursing Interventions into Multimedia Technologies in Nursing Education 2*. The research investigations and implementation of the findings into nursing education are expected to be completed in 2023. The current research communications present findings of the research studies conducted to validate NANDA nursing diagnoses and NIC interventions internationally at academic institutions and clinical workplaces, where future health professionals are being trained. All the involved respondent pools are made up of nursing experts. Universities employ highly erudite academic staff with both professional and especially specialised competence in particular areas of clinical nursing practice, who are competent to create and manage teams of expert nurses to validate a set of nursing diagnoses and nursing interventions. The respondents meet the new research-based expert criteria for validation studies in the clinical setting (Archalous, 2022). Given the breadth and scope of the investigation, we present a validated set of empirically verified nursing interventions for NIC nursing diagnosis: Risk for Infection 00004 in gynaecological, obstetric and neonatal nursing. It is designed for clinical practice and implementation into the training of health professionals, leading to the acquisition of exit competences after completion of undergraduate study programmes (Creason, 2004; Carpenito-Moyet, 2004). With the author's permission, we used in our validation study two nursing interventions included in the Nursing Interventions Classification (NIC; 7th edition) relevant to the nursing diagnosis Risk for Infection 00004 from Taxonomy II NANDA - International (2021-23) entitled *Minimizing Acquisition and Transmission of Infectious Agents* with 36 activities/practices and *Prevention and Early Detection of Infection in a Patient at Risk* with 33 activities/practices. The validation study was conducted during the Covid pandemic and became highly relevant not only in gynaecological and obstetric-neonatal care but in all sections of nursing care as well.

2 Purpose

The purpose of the research was to assign nursing interventions of the Nursing International Classification system (NIC) to the nursing diagnosis evaluated by experts in each field of nursing as the most common, and to validate them in clinical practice. Within the research investigation, experts/clinical nurses and experts/academic nurses defined the most important and most frequently used nursing diagnosis in each nursing discipline, by which means the nursing diagnosis of *The NANDA International: Nursing Diagnoses. Definitions and Classification 2021-2023 Risk for Infection Code 00004, Domain 11, Class 1, defined as susceptibility to infestation and multiplication of pathogenic organisms that may lead to impaired health* was included in the research. To the diagnosis, activities/practices of two interventions of the *Nursing Interventions Classification (NIC) 7th edition, St. Louis: Elsevier: 2018* were assigned. A group of experts constructed a measurement tool with criteria for the selection of a nursing intervention validation expert and with the items (activities/practices of interventions NIC) identified for validation (with respect to NIC copyright). The purpose of the study was to determine which activities/practices of two NIC interventions for the nursing diagnosis Risk for Infection 00004 are rated as significant, i.e. core (acute) and secondary by experts/nurses/midwives from academic and clinical nursing settings in the Slovak Republic (hereinafter as SR) and the Czech Republic (hereinafter as CR). Furthermore, to find out which of them are considered as insignificant, i.e. discarded, in care.

3 Methods

For the validation study, a measurement tool, i.e., an anonymous questionnaire that included the activities/practices related to the chosen nursing diagnosis was used. All 69 activities/practices of the two interventions NIC for the nursing diagnosis Risk for Infection 00004 NANDA-I were validated by the clinical and academic experts/nurses who met the established criteria. The first intervention applying to the nursing diagnosis Risk for Infection 00004, entitled *Intervention I: Infection Control*, defined as - *Minimizing of Acquisition and Transmission of Infectious Agents*, code 6540 (NIC, 7th Edition), was included in the measurement tool and contained a total of 36 items (activities/practices) plus one false item. A second intervention, *Intervention II: Infection Protection*, defined as *Prevention and Early Detection of Infection in the Patient at Risk*, code 6550 (NIC, 7th ed.) was included in the measurement tool with a total of 33 items (activities/practices) plus one false item. The Diagnostic Content Validity Model (DCV) was used for validation. Fehring's method was used for the research utilizing an anonymous questionnaire that included selected interventions NIC (Fehring, 1986; 1994). The total number of all participants in the validation research, i.e. academic nurses/educators/experts and clinical nurses/experts ($n_c=848$) of two countries – SR and CR included four subsets ($n_1=443$, $n_2=342$, $n_3=47$, $n_4=16$). The number of experts/nurses was 785 (92.25%), the number of experts/academic nurses/educators was 63 (7.75%), and the total sample size was 848.

Table 1 Activities/practices of Intervention I Infection Control, code 6540 (items No.1-37; one false item)

1.	Allocate the appropriate square meters per patient, as indicated by Centers for Disease Control and Prevention (CDC) guidelines
2.	Clean the environment appropriately after each patient use
3.	Change patient care equipment per agency protocol
4.	Isolate persons exposed to communicable disease
5.	Place on designated isolation precautions, as appropriate
6.	Maintain isolation techniques, as appropriate
7.	Limit the number of visitors, as appropriate
8.	Teach improved hand washing technique to health care personnel
9.	Instruct patient on appropriate hand washing techniques
10.	Instruct visitors to wash hands on entering and leaving the patient's room
11.	Use antimicrobial soap for hand washing, as appropriate
12.	Wash hands before and after each patient care activity
13.	Institute universal precautions
14.	Wear gloves as mandated by universal precaution policy
15.	Wear scrub clothes or gown when handling infectious material
16.	Wear sterile gloves, as appropriate
17.	Scrub the patient's skin with an antibacterial agent, as appropriate
18.	Shave and prepare the area, as indicated in preparation for invasive procedures and/or surgery
19.	Maintain an optimal aseptic environment during bedside insertion of central lines
20.	Maintain an aseptic environment when changing total parenteral nutrition (TNT) tubing and bottles
21.	Maintain a closed system during invasive haemodynamic monitoring
22.	Change peripheral IV and central line sites and dressings according to current Centers for Disease Control and Prevention guidelines
23.	Ensure aseptic handling of all IV lines
24.	Ensure appropriate wound care technique
25.	Use intermittent catheterisation to reduce the incidence of bladder infection
26.	Teach patient to obtain midstream urine specimens at the first sign of return of symptoms as appropriate
27.	Encourage deep breathing and coughing, as appropriate
28.	Promote appropriate nutritional intake
29.	Encourage fluid intake, as appropriate
30.	Encourage rest
31.	Administer antibiotic therapy, as appropriate
32.	Administer the immunizing agent, as appropriate
33.	Instruct patient to take antibiotics, as prescribed
34.	Teach patient and family about signs and symptoms of infection and when to report them to the health care provider
35.	Teach patient and family members how to avoid infection
36.	Promote safe food preservation and preparation
37.	Serve an ice cream sundae

Table 2 Activities/practices of Intervention II Infection Protection, code 6550 (items No.1-34; one false item)

1.	Monitor for possible systemic and localized signs and symptoms of infection
2.	Monitor vulnerability to infection
3.	Review histories of international and global travels
4.	Monitor absolute granulocyte count, WBC, and differential count
5.	Follow neutropenic precautions, as appropriate
6.	Limit the number of visitors, as appropriate
7.	Avoid close contact between pet animals and immunocompromised hosts
8.	Screen all visitors for transmissible disease
9.	Maintain asepsis for patient at-risk
10.	Maintain isolation techniques, as appropriate
11.	Provide appropriate skin care to oedematous areas
12.	Inspect skin and mucous membranes for redness, extreme warmth, or dryness
13.	Inspect condition of any surgical incision and wound
14.	Obtain cultures, as needed
15.	Promote sufficient nutritional intake
16.	Encourage fluid intake, as appropriate
17.	Encourage rest
18.	Monitor for change in energy level or malaise
19.	Encourage increased mobility and exercise, as appropriate
20.	Encourage deep breathing and coughing, as appropriate
21.	Administer an immunizing agent, as appropriate
22.	Instruct patient to take antibiotics as prescribed
23.	Maintain judicious use of antibiotics
24.	Do not attempt antibiotic treatment for viral infections
25.	Teach the patient and patient's family the differences between viral and bacterial infections
26.	Teach the patient and family about the signs and symptoms of infection and when to report them to the health care provider
27.	Teach patient and family members how to avoid infections
28.	Eliminate fresh fruits, vegetables, and pepper in the diet of patients with neutropenia
29.	Remove fresh flowers and plants from patient areas, as appropriate
30.	Provide private room, as needed
31.	Ensure water safety by instituting hyperchlorination and hyper-heating, as appropriate
32.	Report suspected infections to infection control personnel
33.	Report positive cultures to infection control personnel
34.	Discharge the patient

Out of the total pool of $n_c=848$ experts, the total number of Slovak and Czech experts/clinical nurses was $n_k=785$ (Table 3 Expert/clinical nurse sets in the process of validation of Nursing Diagnosis Risk for Infection 00004 Interventions I, II). The experts of the total set were from universities and teaching hospitals of SR and the CR. Two interventions for the nursing diagnosis (NIC) Risk for Infection 00004 (NANDA-I) containing a total of 71 activities/practices (two were false items) were validated in academic and clinical settings of different nursing disciplines. The experts of the total sample ($n_c=848$) identified all 69 validated items as significant (i.e., core and secondary) in the nursing diagnosis of Risk for Infection 00004, with 49 core (acute) and 20 secondary items. The first intervention with a weighted score – VS 0.91 – 0.71 (37 activities (one false), 33 core, 3 secondary), the second intervention VS 0.89 – 0.53 (34 activities (one false), 16 core, 17 secondary).

Table 3 Expert/clinical nurse sets in the process of validation of Intervention I, II for nursing diagnosis Risk for Infection 00004

Sets	n _k	%
Slovak Republic – nurses n ₁	443	52.24
Czech Republic – nurses n ₂	342	40.33

NIC intervention activities for nursing diagnosis Risk for Infection in obstetrical and neonatal nursing

The aim of the research study was to determine which activities/practices of the two NIC interventions for the nursing diagnosis Risk for Infection 00004 are evaluated by experts/nurses from the academic and clinical obstetric-neonatal nursing care settings in SR and CR as significant, i.e. core (acute) and secondary. Furthermore, to find out which of them they consider as insignificant, i.e. excluded, in obstetric and neonatal nursing. The research was carried out at the Faculty of Social Sciences and Health Care, the University of Constantine the Philosopher in Nitra in collaboration with the Faculty of Health Care Studies, the University of West Bohemia and Faculty of Health Care, the University of Presov with the support of the Kega project entitled *Implementation of Nursing Interventions in Multimedia Technologies in Nursing Education 2*. The research investigations and implementation of their results in nursing education took place from 2020 to 2023.

Methods and Data Set. The Likert Scale and Fehring's Diagnostic Content Validity Model (DCV model) were used for the research. The Likert Scale with a five-point significance rating on a scale of 1 to 5 (1-no significance, 2-low significance, 3-medium significance, 4-high significance, 5-topmost significance). In the next stage of Fehring's Diagnostic Content Validity Model (DCV model), a weighted score for each item/activity was calculated by summing the values assigned to each response and then dividing it by the total number of responses. The values are assigned to the answers as follows: 5=1; 4=0.75; 3=0.5; 2=0.25; 1=0. Responses that achieve a weighted score greater than 0.80 (0.75 according to Fehring, 1986, p. 188; Creason, 2004, p. 124) are considered significant. These activities are referred to as highest priority, core, or acute (major, critical). Activities with a weighted score of less than 0.80 and more than 0.50 are of lower priority. Activities with a weighted score ≤ 0.50 were considered clinically invalid and therefore diagnostically insignificant and suitable for exclusion. A total of four measurement tools in two languages were used for the validation study in obstetric-neonatal nursing. The measurement tool was an anonymous questionnaire consisting of an anamnestic section that contained selection criteria for the nursing intervention validation expert, and an investigation section. The latter one included the activities of the two interventions NIC for Infection Control (defined as *Minimizing Acquisition and Transmission of Infectious Agents*), code 6540, and Infection Protection (defined as *Prevention and Early Detection of Infection in the Patient at Risk*), code 6550 related to the NANDA-I Nursing Diagnosis Risk for Infection 00004. A total of 71 items (code 6540 items No.1-37; code 6550 items No.1-34) were included in the questionnaire (Table 1, Table 2). The selected sample included a total of 79 experts/nurses (n=79) of the academic and clinical obstetric-neonatology nursing and consisted of four subsets (n₁, n₂, n₃, n₄) of which 60 experts were from SR and 19 experts from the CR. Slovak educators were n₁=47 (59.5%); Czech educators n₂=16 (20.3%); Slovak nurses n₃=13 (16.5%); Czech nurses n₄=3 (3.8%). A total of 71 items of the two NIC interventions for the nursing diagnosis Risk for Infection were evaluated, which included 69 activities/practices and two false items.

4 Results

We found out that the Slovak and Czech experts/nurses and experts/educators rated the activities/practices of Intervention I, Infection Control (defined as *Minimizing acquisition and transmission of infectious agents*) as significant, i.e., core and secondary, except for items 25, 26, 27, 30 and 37 (false). They considered these items as insignificant, i.e. discarded. Regarding intervention II, Infection Protection (defined as *Prevention and*

early detection of infection in at-risk patients), they identified all the items as significant, i.e., core, and secondary except No. 3, 4, 8, 17, 19, 20, 22, 28, 29, 30, 31 and 34 (false), which they discarded.

Regarding the first intervention, items No. 22 and 23 (VS=0.98) were identified as the most significant. For the second intervention, the total set of respondents identified item No.13 as the most significant (VS=0.80). There were differences between the subsets of experts in their ratings of the importance of each activity.

Table 6 Validation of the activities of Intervention I named Infection Control, code 6540 in obstetric-neonatal nursing by experts n₁ - n₄

Activity/NIC ₃₇	I1	I2	I3	I4
15	16	17	18	19
I10	I11	I12	I13	I14
115	116	117	118	119
120	121	122	123	124
125	126	127	128	129
130	131	132	133	134
135	136	137		
n ₁ =SR/ Educators	0,59	0,87	0,84	0,93
	0,9	0,89	0,87	0,84
	0,86	0,82	0,89	0,63
	0,8	0,91	0,81	0,83
	0,91	0,92	0,91	0,94
	0,82	0,81	0,81	0,79
	0,73	0,84	0,78	0,88
	0,83	0,71	0,28	0,85
n ₂ =CR/ Educators	0,56	0,92	0,89	0,89
	0,88	0,86	0,64	0,84
	0,8	0,69	0,89	0,69
	0,69	0,75	0,59	0,73
	0,81	0,88	0,83	0,84
	0,66	0,52	0,55	0,61
	0,5	0,67	0,61	0,78
	0,59	0,59	0	0,7
n ₃ =SR/ Nurses	0,88	0,94	0,9	0,94
	0,81	0,92	0,94	0,92
	0,9	0,83	0,96	0,92
	0,48	0,62	0,44	0,42
	0,98	0,52	1	0,98
	0,27	0,31	0,33	0,9
	0,37	0,81	0,77	0,38
	0,85	0,88	0,04	0,81
n ₄ =CR/ Nurses	0,83	0,92	0,58	0,83
	0,83	0,75	0,75	0,75
	0,75	0,83	0,83	0,75
	0,83	0,67	0,75	0,83
	0,83	0,92	0,92	1
	0,92	1	0,83	0,92
	0,83	0,92	1	1
	1	1	1	1
Total (n ₁ , n ₂ , n ₃ , n ₄)	0,88	0,89	0,94	0,84
	0,92	0,81	0,91	0,89
	0,94	0,88	0,83	0,94
	0,84	0,55	0,63	0,5
	0,95	0,95	0,59	0,98
	0,53	0,39	0,44	0,42
	0,53	0,45	0,83	0,81
	0,84	0,88	0,91	0,22

The subset of Slovak educators n₁=47 marked all items as significant, the most significant item being item No. 19 (VS=0.96); the subset of Czech educators n₂=16 marked 35 items as significant, the most significant item being item No. 2 (VS=0.92) and one item as insignificant/excluded – item No. 30 (VS=0.5); the subset of Slovak nurses n₃=72 marked 26 items as significant, the most significant item No. 22 (VS=1) and ten items insignificant/excluded; the subset of Czech nurses n₄=13

marked all items as significant, the most significant items were No. 23, 26, 29, 32, 33, 34, 35 and 36.

The total set of experts rated 29 activities/practices as significant, and eight items (including one false item) as not significant, i.e. discarded. As the most significant items were identified No.22 and 23 of Intervention I: *Replace peripheral IV and central lines, and dressings according to current Centers for Disease Control and Prevention guidelines; Ensure aseptic handling of all IV accesses.*

Table 7 Validation of activities of Intervention II named Infection Protection, code 6550 in obstetric-neonatal nursing by experts $n_1 - n_4$

Activity/NIC ₃₄	II1	II2	II3	II4
II5	II6	II7	II8	II9
II10	II11	II12	II13	II14
II15	II16	II17	II18	II19
II20	II21	II22	II23	II24
II25	II26	II27	II28	II29
II30	II31	II32	II33	II34
$n_{1_SR/}$ Educators	0,91	0,74	0,72	0,71
0,71	0,76	0,64	0,65	0,91
0,9	0,8	0,81	0,9	0,84
0,8	0,84	0,74	0,68	0,68
0,78	0,77	0,84	0,81	0,82
0,78	0,81	0,82	0,66	0,62
0,68	0,55	0,81	0,85	0,45
$n_{2_CR/}$ Educators	0,78	0,64	0,47	0,48
0,47	0,48	0,5	0,42	0,78
0,78	0,66	0,67	0,83	0,75
0,72	0,72	0,61	0,61	0,63
0,61	0,69	0,86	0,89	0,61
0,55	0,7	0,61	0,42	0,38
0,44	0,44	0,73	0,77	0,25
$n_{3_SR/}$ Nurses	1	0,87	0,27	0,29
0,5	0,71	0,5	0,4	0,94
0,96	0,69	0,73	0,52	0,85
0,75	0,44	0,33	0,56	0,37
0,38	0,62	0,38	0,85	0,58
0,77	0,83	0,79	0,37	0,38
0,38	0,37	0,77	0,77	0,08
$n_{4_CR/}$ Nurses	0,83	0,92	0,83	0,67
0,83	0,92	0,75	0,75	0,83
0,92	0,75	0,75	0,92	0,75
0,67	0,92	0,67	0,75	0,92
0,92	0,83	0,58	0,83	0,83
0,58	0,75	0,83	0,92	0,83
0,83	0,75	1	0,83	1
Total (n_1, n_2, n_3, n_4)		0,97	0,88	0,38
0,36	0,56	0,75	0,55	0,47
0,92	0,95	0,7	0,73	0,59
0,83	0,73	0,53	0,39	0,59
0,47	0,48	0,66	0,42	0,84
0,63	0,73	0,81	0,8	0,47
0,47	0,47	0,44	0,81	0,78
0,25				

The subset of Slovak educators $n_1=47$ marked all items as significant, the most significant items were No. 1 and 9 (VS=0.91); the subset of Czech educators $n_2=16$ marked 23 items as significant, the most significant item was No. 23 (VS=0.89) and eleven items as insignificant/excluded (including one false item) No. 3, 4, 5, 6, 7, 8, 28, 29, 30, 31 and 34 (VS=0.5); the subset of Slovak nurses $n_3=72$ marked 19 items as significant, the most significant item No. 1 (VS=1) and 15 items as insignificant/excluded; the subset of Czech nurses $n_4=13$ marked all items as significant, the most significant items were No. 23, 26, 29, 32, 33, 34, 35 and 36.

The total set of experts rated 22 activities/practices as significant and 12 items (including one false) as not significant, i.e.

discarded. The most significant was item No. 1 of Intervention II: *Monitor possible systematic and localized signs of infection.*

6 Discussion

The 2022 Ancira-Moreno study documents activities in relation to the evaluation of nutritional care for the mother and child in primary health care and the impact on their health. The different stages of the research focused on mothers in Mexico and its topic was maternal and child malnutrition. It aimed at the development of a set of indicators to evaluate the quality of nutritional care for the mother and child in primary health care. The research methods were indicators for different stages of life: pregnancy, neonatal and infant ages, toddlerhood and preschool age of the child. A systematic review of the literature on prevention, diagnostics and treatment of various forms of malnutrition, and recommendations included in a series of resolutions was conducted. Based on the evaluation, 22 indicators were constructed for content validation. The research validated and verified 16 indicators to evaluate nutritional care for the mother and child in primary health care (Ancira-Moreno, 2022).

The 2018 study by Purwaningrum covers activities/practices of child feeding and nutrition-related interventions. The aim of the research was to validate a worthy measurement tool for parental child feeding practices (hereafter referred to as PCFP) in low- and middle-income countries. PCFP tools were developed in countries with a high food intake and a high prevalence of childhood obesity. The aim of the validation study was to test the appropriateness, content and construct validity of selected PCFP measurement activities in low- and middle-income countries where both child undernutrition and obesity are prevalent. The expert panel selected subscales and items from the PCFP measurement tool that were well testable in high-income countries to measure both "compulsive" and "addictive" behaviours. Two cross-sectional studies were conducted in two provinces in Indonesia. Research results from the first study were used to refine the subscales for the second phase of the research. Other research included content validity from the perspective of the mothers/respondents participating in the validation study. Content, factorial validity and reliability were tested. Convergent validity was tested with child nutritional status (Purwaningrum, 2018).

Interventions to manage perinatal anxiety were explored by author Victoria Anne Silverwood (2022) and presented in the study entitled *Approaches to Managing Perinatal Anxiety*. Perinatal Anxiety (PNA) is defined as anxiety occurring during pregnancy and up to 12 months postpartum and is estimated to affect up to 20% of women. The author highlighted a range of risk factors causing anxiety, the difficulty of diagnostics and the current state of perinatal anxiety in women. Furthermore, she pointed out the lack of a research-validated test for the detection and diagnostics of PNA and its erroneous confusion with perinatal depression. Clinical guidelines currently recommend pharmacological and psychological interventions for the management of women with PNA. However, the limited research suggests that other interventions may be effective. This study documents research-validated effective non-pharmacological interventions in primary care of women with PNA. It provides an overview of PNA, evidence of PNA including risk factors, the process of diagnostics and most importantly, effective interventions for the management of perinatal distress (Silverwood, 2022).

A study by Segal (2020) highlights the need for interventions to identify Hepatitis B virus (HBV) infection and infection risk for pregnant women and transmission to the baby. There is a lack of hepatitis B virus (HBV) DNA measurement in low- and middle-income countries, and this situation hinders the identification of pregnant women at risk of perinatal to foetal transmission. This study evaluates the validity of selection of specific interventions/activities in relation to the algorithm of HBeAg-positive women and HBeAg-negative women with an alanine aminotransferase (ALT) ≥ 40 IU/L as a predictor of high HBV

DNA levels. During the study, pregnant women with hepatitis B surface antigen (HBsAg) reactivity were evaluated. They were evaluated by SD BIOLINE HBeAg rapid test and HBV DNA quantification. The validity of the HBeAg and the algorithm to identify HBV DNA >2 thresholds (5.3 and 7.3 log₁₀ IU/ml) were evaluated. The result of the investigation showed that an algorithm intervention using HBeAg and ALT levels could be an effective strategy to identify pregnant women infected with HBV at risk of perinatal transmission in the countries where HBV DNA quantification is not routinely available (Segal, 2020).

The research by Thomas G. Power in 2021 presents the results of an examination of general dietary interventions, practices, habits, and maternal eating styles in relation to infant weight. The study examined the relationships among parenting, eating activities and practices in a sample of 187 low-income Hispanic mothers. Mothers of children in the Head Start programme participated in the larger study, where indicators, such as parenting, feeding styles, practices, and dietary interventions were assessed by means of questionnaires. Results identified numerous associations between general dimensions of parenting and specific feeding practices, i.e., maternal upbringing was positively associated with healthy eating guidance and responsiveness to feeding modifications; inconsistency was positively associated with weight restriction and promotion of overconsumption; adherence to discipline was positively associated with monitoring, healthy eating guidance, and responsiveness to feeding; and family organization was positively associated with monitoring and healthy eating guidance. General parenting styles were related to feeding practices, with authoritative mothers showing the highest level of healthy eating advice but at the same time the lowest level of monitoring. There was no significant association between mothers' general parenting style and mothers' eating style. The implications of these findings for the prevention of childhood obesity are being considered (Power, 2021). Comparative analyses of the most appropriate formulas for developing optimal child nutrition practices were presented in a study by Stephen Kofi Anin et al. in 2022. These were related to public child health, malnutrition, and epidemiological interventions in nutrition (Anin et al., 2022).

7 Conclusion

The results of international studies provide new knowledge for the development of nursing clinical practice in obstetric-neonatal nursing and allow comparison of nursing interventions and their activities between Czech-Slovak and international validation studies. The current ones strengthen the implementation of the results of research investigations into study programmes and into the development of curricula for future nurses and midwives, consequently expanding the possibilities of objective validation of NIC (Nursing Interventions Classification) nursing interventions in relation to selected nursing diagnoses. They contribute to the professionalisation of care for women and children.

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MACHINE LEARNING POSSIBILITIES TO PREDICT SEVERE OBSTETRIC COMPLICATIONS

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Abstract: Predicting severe obstetric complications – hemorrhages – still is an important medical, demographic, and economic problem throughout the world. In the high-tech era, artificial intelligence seems to be a promising tool for dealing with this problem. This work presents results of information search for the actual experience with various methods of predicting obstetric bleedings. Long-term benefits of applying machine learning algorithms for the said purposes have been shown, and their implementation challenges have been covered. Development of digital predictive models backed up with machine learning algorithms is expected to break new ground for enhancing the precision of identifying personalized risk of bleeding. This assumption relies on the successful Russian and worldwide experience in implementing integral systems of predictive analytics into such branches of medicine, as oncology, cardiology, ophthalmology, and reproductive medicine.

Keywords: artificial intelligence, predicting, obstetric bleeding, postpartum hemorrhage, machine learning.

1 Introduction

Bleedings which occur during pregnancy, labor, the placental stage, and early postpartum period are usually referred to obstetric bleedings (OB). The index of obstetric bleedings ranges from 3 to 8% of the general number of childbirths; meanwhile, 2–4% of obstetric bleedings are associated with hypotonia of the uterus in the placental and early postpartum period, with around 1% of the bleedings being observed in cases of premature detachment of the normally situated placenta and placenta previa (Khashukoeva et al., 2004). Although occurrence of obstetric bleedings may vary from country to country, however, obstetric bleedings are still the major preventable cause of maternal morbidity and mortality throughout the world.

Every day, some 830 women worldwide die from obstetric bleeding (Sebghati & Chandrarahan, 2017). In Australia, Canada, the UK, and the USA, a rising trend of postpartum hemorrhages is observed (Knight et al., 2009). In the Russian Federation, decrease can be traced in the obstetric bleeding index within the structure of maternal mortality (MM), as well as decrease in the MM index in general. However, hemorrhages keep their leading position among the major causes of MM during pregnancy, labor, and postpartum period (Maternal mortality in the Russian Federation in 2018, 2019). The systematic analysis of maternal mortality causes for the years 2003 to 2009 conducted by the World Health Organization (WHO) demonstrated that bleeding was the leading direct cause of maternal mortality throughout the world, amounting to 27,1% (19,9–36,2%). Meanwhile, over two thirds of all registered cases of death due to bleeding were classified as postpartum hemorrhage (Say et al., 2014).

As defined by the WHO, postpartum hemorrhage (PPH) is the blood loss volume of over 500 ml after vaginal delivery and over 1000 ml after the cesarean operation. The American College of Obstetricians and Gynecologists (ACOG) currently defines postpartum hemorrhage as either the general blood loss of not less than 1000 ml or hypovolemia signs or symptoms present within 24 hours after childbirth (Committee on Practice Bulletins-Obstetrics, 2017). OB are the cause of critical conditions, as well as near miss incidents ("almost lost" women or "bare survivors"): as a rule, in situations of the insufficient scope of obstetric care, if there is massive blood loss, and disorders develop in the hemostatic system (Surina & Marochko, 2016).

Maternity patients having severe bleeding may need blood transfusion, surgical treatment (including hysterectomy), or admission to the intensive care unit, with a certain percentage of lethal outcomes being possible. Postpartum hemorrhage entailing blood transfusion is the leading cause behind severe maternal pathologies in the USA (Creanga et al., 2014).

The causes of postpartum hemorrhage can be classified using the 4T mnemonics: "tone" (uterine hypotonia and atony), "trauma" (injury of birth canal accompanied by bleeding), "tissue" (fragments of placenta retained in the uterine cavity), and "thrombin" (blood coagulation system disorders). Uterine atony is the most frequent cause of postpartum hemorrhage; according to research data, up to 79% of all cases of PPH are associated with atony of the uterus (Bateman et al., 2010). Distention of the uterus as a result of multiple gestation, polyhydramnios and fetal macrosomia, faulty placentation with abruption of placenta, placenta previa, chorioamnionitis, artificial and prolonged labor, and prolonged exposure to oxytocin are referred to uterine atony development factors (Bateman et al., 2010; McLintock & James, 2011). Contributory causes of development of bleedings due to birth canal injuries or during operative delivery include obesity, cardiac insufficiency, faulty placentation with abruption of placenta, placenta previa, chorioamnionitis, and preeclampsia (Al-Zirqi et al., 2008; McLintock & James, 2011; Sebire et al., 2001). Predictors of PPH resulting from coagulopathy include hereditary diseases associated with clotting disorders: Willebrand disease, hemophilia carrier status, deficiency of coagulation factor X, and rare disorders of blood coagulation system (James, 2005). Among others, coagulopathy risk factors are HELLP-syndrome (hemolysis, hepatic enzyme elevation, and a low platelet count), the use of anticoagulants, amniotic embolism, and massive blood loss (Al-Zirqi et al., 2008; McLintock & James, 2011). Meanwhile, a high body mass index (BMI) presents an independent risk of postpartum hemorrhage; so, for example, the BMI value of over 30 increases the probability of severe PPH (over 1000 ml) by almost 50% (Al-Zirqi et al., 2008).

Revealing patients who have a high risk of postpartum hemorrhage will allow taking effective measures of prevention promptly, which will have a significant impact on reduction of morbidity and mortality of the patients, yield lower economic costs of treatment, and improve outcomes for the patients ultimately. Prediction of postpartum hemorrhage based on the information available is a domain of immense clinical opportunities. In clinical practice, application of predictive models developed helps evaluate risks of bleeding. Such forecasts can have a real-time effect on decision-making. For example, such decisions include alteration of birth plan in favor of cesarean operation, preventive prescription of uterotonic and hemostatic drugs, or transfer to a center providing a higher level of obstetric care (Westcott et al., 2020).

The problem of revealing risk factors and predicting obstetric bleedings has remained urgent in spite of numerous studies in this domain. Conventional statistical methods have a number of limitations due to which the use of predictive models, even the theoretically verified ones, is not always possible in the actual clinical practice. Among such limitations, there is non-uniformity of the studies and a limited quantity of data for analysis which is not always capable to represent the real-life clinical situation. Standard statistical methods evaluate the contribution of each one of the limited number of predictors individually, while overlooking relationships among them.

Prediction of bleedings has been a challenging problem for obstetrics. Further elaboration of this domain using new knowledge and state-of-the-art techniques seems promising. The total of modern scientific developments and advanced computer technologies which include artificial intelligence, databases of big data, and cloud-based computing, open up vast opportunities for predicting obstetric complications, bleedings included. The use of artificial intelligence seems to be an efficient prediction

method in real-life clinical practice which will enable clinical physicians to make well-timed decisions on prevention and scope of medical care.

2 Literature Review

Artificial intelligence (AI) is a branch of computer science dealing with the use of computers and information technologies for modeling intelligent behavior and critical thinking which would be comparable to the human ones.

Almost immediately after invention of the first computers, people started to ask the question if it was possible to create a machine able to demonstrate intellectual capacity which would be similar to the human one. Back in 1950, in his article "Computing machinery and intelligence", the English mathematician Alan Turing developed and published a test proving the capacity of machines to imitate human behavior and thinking (Mintz & Brodie, 2019). A bit later, in 1956, John McCarthy was the first to describe the term "artificial intelligence" as a science and technology of creating smart machines (Amisha et al., 2019). The 1980s and 1990s saw a surge of interest in AI in many domains, including healthcare. Artificial intelligence methods, namely, fuzzy expert systems, Bayesian networks, artificial neural networks, and hybrid intelligent systems, have been utilized in medicine in diverse clinical conditions (Amisha et al., 2019). As of today, the level of computing capacities of machines has soared up to instant computations and the ability to analyze data in the real-time mode (Mintz & Brodie, 2019).

In different countries of the world, scientists have made repeated attempts to develop efficient prediction models for obstetric bleedings. For example, Ana Rubio-Álvarez and her colleagues (2018) (Spain) developed a model for predicting bleedings which occur after delivery via the natural birth canal. They tested the model out in clinical practice, too. The model relies on post-hoc analysis of the data of digital medical records of 2336 women having single vaginal delivery. In this study, blood loss was defined as hemoglobin decreased to less than 3,5 g/dl. For data analysis, they used standard methods of medical statistics, such as chi-square test, Student t-test, Lemeshow test, and binary logistic regression. In the course of the research, the principal predictors of postpartum hemorrhages were identified: age, first labor, high duration of the first and second periods of labor, weight of the newborn, and the level of hemoglobin before labor. In their conclusions, the scientists point out a high predictive power of the developed model (Rubio-Álvarez et al., 2018).

Scientists from the Netherlands, Corine M. Koopmans together with colleagues (2014), proposed their predictive models of obstetric bleedings. The data for the research had been obtained from 38 hospitals of the Netherlands for the years 2005 to 2008, with 1132 women involved in the research. The analysis was conducted using conventional statistical methods, logistic regression included. The authors developed two models calculating bleeding risks on the basis of the antenatal and intranatal data (Koopmans et al., 2014). In the course of their study, the most significant risk factors of obstetric bleedings were found, in particular: age, BMI, preeclampsia, weight of the fetus, and retention of afterbirth. Among the intranatal factors, the most crucial ones were a high duration of opening of the uterine orifice, and episiotomy (Koopmans et al., 2014).

Italian researcher Eugenia Biguzzi and her colleagues (2012) created a model for predicting postpartum hemorrhages based on multivariate logistic regression. The research data had been obtained from digital medical records of 6011 women who had delivered via the natural birth canal within the time span of the year 2007 to 2009. The model is built on the basis of a monogram, which allowed visually estimating the contribution of certain risk factors of bleeding. Among the most important predictors of obstetric bleedings, the scientists revealed the body mass, Asian and Latin American ethnic origin, episiotomy, retention of afterbirth, weight of placenta, body mass of the

newborn, as well as the level of hemoglobin before labor (Biguzzi et al., 2012).

Sarit Helman together with colleagues (2015) conducted a post-hoc study relying on databases and information from the blood bank for the time span from 2005 to 2014. They analyzed the data of 113342 women, 0,1% of whom had a massive hemorrhage (Helman et al., 2015). A step-by-step predictive model of obstetric bleedings based on logistic regression was built. So, among the risk factors, the largest contribution belonged to the past history of cesarean operation, spontaneous miscarriage, multiple gestation, induction of labor, current cesarean operation, and artificial delivery. The advantage of this research consisted in the large sample size and the use of high-accuracy statistical models (Helman et al., 2015).

Jill M. Westcott and his colleagues (2020) (Maternal and fetal medicine department, Obstetrics and gynecology department, New York) conducted a post-hoc cohort study at the NYU Langone Health medical center for prediction of obstetric bleedings with the help of machine learning algorithms. Using computer technologies, they analyzed the data of 30867 digital medical records obtained within the time span from July 2013 through October 2018. Within the study, the scientists assessed demographical parameters, the patients' medical, obstetric, and surgical history, results of laboratory tests, and any medications used. As the criterion of bleeding, they defined blood loss at the volume of over 1000 ml. Thus, bleeding occurred in 2179 of all the patients under study. All the data were subdivided into 2 groups: 70% for learning and 15% for verification. To evaluate the efficiency, the indicators of accuracy, sensitivity, and AUC were used. Predicting was performed by means of supervised learning with the use of logistic regression, random forest, and decision tree with gradient amplification (XGBoost), as well as support vector machine. So, they created two models in the course of the work: 1) for the data obtained before childbirth, 2) for the data available up to the second period of labor as of the point of decision-making on the obstetric tactics. As a result of the research, the most important risk factors of obstetric bleedings have been identified: BMI, hematocrit level, urgent and planned cesarean operation, the platelet level during labor. The best result was yielded by XGBoost decision tree: for the first model, its accuracy amounted to 98,1%, sensitivity – to 0,763, and AUC – to 0,979, while for the second model, the accuracy was 98%, sensitivity was 0,737, and AUC was 0,955. The first model turned out to be able to successfully predict almost 3 of every 4 female patients who had postpartum hemorrhage. Importantly, many risk factors among those considered were not included into the final risk assessment due to their low predictive value; here belonged, for example, multiple gestation, operative vaginal delivery, and the past history of bleeding. This is indicative of the fact that many risk factors do not contribute to the development of obstetric bleedings so much as they used to be believed to. Therefore, this domain needs further research to detect objectively significant risk factors of obstetric bleedings (Al-Zirqi et al., 2008).

Yawei Zhang, Xin Wang and their colleagues (2021) (Obstetrics department, Beijing Obstetrics and Gynecology Hospital of the Capital Medical University, China) studied the opportunities of ensemble machine learning in the context of predicting postpartum hemorrhages. The research was conducted with the data of 3842 childbirths of the year 2017, where postpartum hemorrhage was registered in 361 cases. It is important to note that the data had an imbalance of positive and negative cases, which brings the research closer to the real-life clinical practice conditions. For the analysis, they selected 23 characteristics associated both with pregnancy and with labor directly. These included age, parity, gestational age, anemia present and the level of hemoglobin, the kind of amniotic fluid, pre-induction and induction methods, timeliness of amniotic fluid discharge, pain relief methods, labor stimulation with oxytocin and duration of its administration, duration of labor, integrity of the birth canal, uterine tone, and weight of the fetus. All the data obtained were subdivided into 2 groups: 65% of them set aside for

learning and 35% – for testing. For the analysis, ensemble learning was used, including random forest, XGBoost, decision tree with gradient amplification, and SVM. The model developed has demonstrated a high predictive ability, with accuracy of the method amounting to 96,7% in relation to postpartum hemorrhages, and 90,3% – to DIC syndrome (disseminated intravascular blood coagulation). Among the most significant postpartum hemorrhage risk factors, they found uterine tone disorders, duration of labor, injuries of the birth canal, and duration of administration of oxytocin. The scientists expect that owing to the results of forecasts made with the help of the developed model, obstetricians will get an opportunity of using relevant techniques to cope with potential bleeding (Zhang et al., 2021).

Kartik K. Venkatesh and his colleagues (2020) (obstetrics and gynecology department of Duke University, North Carolina, USA) conducted an impressive post-hoc study to assess predictive ability of machine learning models in forecasting postpartum hemorrhages. For the research, they requested depersonalized data from the National Institute on Child Health and Human Development (NICHD): these were the data of digital medical records of 152279 childbirths dated from 2002 to 2008 mined from 12 clinical databases of 19 hospitals in 9 districts of the USA. The group under study comprised deliveries at the gestational age of 23 weeks and more; meanwhile, by postpartum hemorrhage, they understood the blood loss of not less than 1000 ml, regardless of the delivery mode. These criteria were met by 7279 cases. As predictors of bleedings, the scientists considered risk factors declared by CMQCC and ACOG, alongside some additional factors: age, race, any obstetric complications present (placenta previa, fetal macrosomia, preeclampsia), and extragenital pathology (chronic arterial hypertension and diabetes mellitus). For the forecast, two statistical models were developed: the conventional statistical model based on logistic regression and LASSO regression and the ML based model involving random forest and extreme gradient amplification (XGBoost). In the course of analysis, the most significant factors contributing to the development of postpartum hemorrhages have been detected: in particular, they referred here mother's weight before pregnancy and as of admission, BMI, body temperature as of admission, fetal macrosomia, multiple gestation, systolic blood pressure level, and anemia present. The best predictive efficiency has been demonstrated by extreme gradient amplification (its AUC was 0,93, and accuracy was 95%) and random forest (with the 0,92 AUC, and 95% accuracy); both of them did better than LASSO regression results (AUC of 0.87, and accuracy of 95%). The researchers consider the introduction of ML models to be a promising method of predicting postpartum hemorrhages, both individually and combined with conventional statistical methods. Prediction of postpartum hemorrhages can help sort the pregnant women into risk groups and take proactive measures to prevent bleedings. The scientists discuss expedience of integrating similar models into online calculators or automatic concurrent input within digital medical records to be used immediately upon admission of inpatients (Venkatesh et al., 2020).

Jun Liu, Tao Wu, Yun Peng, Rongguang Luo (2020) (Nanchang University, China) conducted the first study with deep learning methods and MRI images of the uterus. The study is aimed at predicting the level of bleeding during cesarean operation in patients with placenta previa in the area of scar after the previous cesarean operation. The data had been obtained from the First Affiliated Hospital of Nanchang University. There were the total of 210 samples; positive cases, for which the blood loss volume was 500 ml and more, numbered 82. The number of negative samples, respectively, where the blood loss volume was less than 500 ml, was 128 cases. The research involved two stages. First of all, the pregnant women got abdominal MRI, and 9 MRI images at 7 mm slice thickness were obtained for each one. Using the artificial neural network and computer software (DeepLab-V3+ network), the area of the uterus in the initial MRI images was recognized and segmented. Next, the data were subdivided into 2 groups – 168 images for learning and 42

images for testing, with 5-times cross-validation conducted after that. The second stage of the research was aimed at prediction of bleedings proceeding from the obtained MRI images of the area of the uterus in question. Each case contained 9 images in the form of independent sampling. Thus, there were 630 positive and negative images for learning and 108 positive and negative images for testing. The analysis was performed on the TensorFlow platform; within it, 6 successive steps of training for convolutional neural network VGGNet-16 were completed. As a result of the study, predictive model of blood loss has been developed. In the comparison of manual and automatic method of prediction, it was the automatic method that has demonstrated best results. The accuracy of the method was 75,6%, its sensitivity – 73,7%, and the specificity was 74,46%. The developed model not only identifies the necessary area of the uterus automatically, but also indicates the level of intraoperative bleeding objectively. Owing to this, the accuracy of experts' conclusion about the level of bleeding during cesarean operation and selection of the necessary hemostasis techniques can be enhanced (Liu et al., 2020).

Japanese scientists Yasunari Miyagi, Katsuhiko Tada and their colleagues (2020) conducted a study using artificial intelligence to find out quantitative relation between the distribution of fibrinogen and fibrin/fibrinogen degradation products (FDPs) as indicators of massive obstetric bleeding. The data had been obtained from Japan's eight national perinatal centers for the time span from 2011 through 2015. The number of deliveries was 22 330, and the number of registered massive bleedings – 154. These are cases of bleeding at the volume of 2000 ml and more, excluding ones with DIC syndrome developing. The total numbered 83 and 71 cases, for cesarean operation and for vaginal deliveries, respectively. The obtained data were subdivided into two groups according to the fibrinogen level. The group having the level of fibrinogen below the threshold criterion was defined as the "low fibrinogen group", while the one where the fibrinogen level was up to the criteria or higher was defined as the "normal fibrinogen group". Distribution of data in both groups was explored with the help of artificial intelligence algorithms. In each group, the median value, the 95th percentile, the average, standard deviation, skewness and excess coefficients of levels of fibrin degradation products were identified. The research was conducted using the Mac platform powered by OS X 10.11.6 (Apple, Inc) and Mathematica 12.0.0.0 software (Wolfram Research). Generation of fibrin degradation products was described with differential equations using the data set of two groups. Theoretically, AI was not compulsory in this study; anyway, its application ensured high efficiency and turned out to be more advantageous in practice. For the massive bleeding in labor, the fibrinogen criterion was 237 mg/dl. It is suggested that as soon as this value of fibrinogen is achieved, the development of coagulopathy is to be expected. Meanwhile, for non-pregnant women, coagulopathy is expected at the level of fibrinogen of 150 mg/dl and lower, according to the guideline of the Japanese Society on Thrombosis and Hemostasis. In their future studies, the scientists are planning to explore these criteria using data sets including the DIC syndrome, as well as evaluation of other coagulation markers, namely, D-dimer, α_2 plasmin, plasminogen activator inhibitor, and prothrombin time (Miyagi et al., 2020).

3 Research Methodological Framework

The objective of this work consists in evaluating the potential of using artificial intelligence in prediction of obstetric bleedings as applied to actual clinical practice.

The following tasks were addressed in the course of the work:

- to conduct information search covering the experience of using various methods of predicting obstetric bleedings;
- to study the potential of using artificial intelligence in prediction of obstetric bleedings;
- to inform a broad circle of specialists in obstetrics and gynecology about the achievements of machine learning

technologies and the prospects of application of artificial intelligence in prediction of obstetric bleedings.

The following methods were used in completing the above tasks and achieving the set objective:

- the method of information search which helped the authors scrutinize sources of medical and scientific technical information on the research topic;
- the analysis method which allowed systemizing the material collected and providing its comparative evaluation;
- the comparison method which enabled the authors to detect ways of solving the problem under study which are the most suitable for the set objective.

4 Results and Discussion

In one way or another, virtually all aspects of today's life are related to big data and machine learning. Netflix knows what movies people prefer, Google knows what people want to know – from their search history, modern automated production is hard to imagine without AI, and utilities, surveillance systems, home appliances (smart home), and personal assistants all work on the basis of AI (Beam & Kohane, 2018). Certainly, the domain of medicine could not overlook this highly promising new tool. In 2016, as compared to other branches, it is applications for healthcare that enjoyed the largest volume of investments into AI studies (Amisha et al., 2019). AI algorithms are used in the medical contexts in the form of making appointments online, registering patients with medical centers online, digitizing medical records, reminding about the following visits and immunization dates for children, and supervising medication intake (Amisha et al., 2019). Artificial intelligence is already in broad use in cardiology, radiology, oncology, endocrinology, ophthalmology, and other branches of medicine (Johnson et al., 2018; Shimizu & Nakayama, 2020; Contreras & Vehi, 2018; Ting et al., 2019). For healthcare, the most valuable aspect of AI is its ability to predict a result based on the previous experience, to elicit risk groups, and to assist in decision-making.

Machine learning (ML) is a section of artificial intelligence where mathematical and statistical approaches are applied for the purpose of enhancing the performance of computers. The term "machine learning" was introduced by Arthur Samuel in 1959; he described it as giving computers the ability to learn without being explicitly programmed (Handelman et al., 2018). There is the following rule for working with ML: the larger bulk of data is analyzed, the more accurate forecast can be expected. In the medical domain, data are a massive resource, therefore, a high predictive accuracy is to be expected from the use of ML. Application of ML in healthcare is economically advantageous. Experts estimate that in medicine and pharmaceuticals ML using big data can yield returns of up to 100 billion USD per annum (Rajula et al., 2020).

Unlike the conventional statistical prediction models, ML not only computes the forecast in relation to new data, but also reveals relationships between various predictors and predicts the outcome of events based on the already available experience. Alongside this, machine learning differs from the statistical methods with its ability to learn from examples, and not with the help of set rules (Sidey-Gibbons & Sidey-Gibbons, 2019).

The key concept of ML implies introducing algorithms which use input data, utilizing computer analysis to predict output values within the acceptable accuracy range, detecting regularities and trends in the data, and, finally, learning from previous experience (Handelman et al., 2018).

There are numerous variants of machine learning models; as a rule, they belong to one of the types described below:

- Supervised learning;
- Unsupervised learning;
- Semisupervised learning;
- Reinforcement learning.

Controlled or supervised learning

In supervised learning, a computer is provided with functions pertaining to the learning objective (for example, demographic data and risk factors of a patient) and with results to be achieved (such as a diagnosis or clinical event) in order to reveal association between the two data sets. This process of deriving variables from previous known examples is enabled by regression analysis. This concept is generally used in statistics, helping enhance the accuracy of forecast. During training, the prediction algorithm becomes capable of evaluating more and more variables and creating sophisticated models of nonlinear relations between independent and dependent variables. The supervised learning technology is focused on classification (for identifying the category of new observation based on the training sample) and regression (predicting values for a variable on the basis of the known values training set). For example, this kind of learning can be used for calculating risk of cardiac diseases, predicting tumor sizes, assessing individual risk of a disease – or predicting the hospital stay duration (Handelman et al., 2018).

Uncontrolled or unsupervised learning. In unsupervised learning, a computer is provided with unclassified data entries to recognize, and it detects if concealed patterns set by researchers are present.

In terms of technology, unlike supervised learning which has to deal with classification and regression, unsupervised learning mainly addresses clustering and dimensionality reduction. Clustering means identification of groups within the data, i.e., the algorithm analyzes the data supplied and identifies any concealed similarities and distinctions enabling it to group subjects into subsections. In medicine, this process is applied in exploring complicated relationships between genetic and biochemical processes in histology and pathology (Handelman et al., 2018).

Semiconrolled (semiautomatic) or semisupervised learning. This is a combination of supervised and unsupervised ML which can analyze a bulk of unlabeled data while simultaneously expanding the opportunities of images recognition with a small quantity of labeled data. In terms of medicine, such an approach is valuable because assigning labels in the information (e.g., in patient records) can be labor-consuming and expensive, given the complexity and abundance of medical data. Moreover, semisupervised learning can enhance the speed and accuracy of information retrieval from large data sets. Among other purposes, semisupervised learning is used for analyzing scientific papers to include them into systematic reviews of the topic under study (Handelman et al., 2018).

Reinforcement learning. This is a particular case of supervised learning. In this model, it is the environment (but not a special control system with reinforcement) that acts as supervisor. Meanwhile, a feedback loop is formed between the environment and the learning algorithm.

The machine learning process implies the following successive stages:

1. Importing the input data and preparing them (data cleaning, ordering) for further analysis, with matrices of terms being formed meanwhile (Lanera et al., 2019). In particular, the information can be obtained from databases comprising a bulk of both structured and unstructured data. The depersonification procedure is compulsory for the data to be used, too.
2. Selecting the required ML algorithms and training them. In the domain of medicine, the most popular ones are decision tree, naive Bayes classifier, random forest, support vector machine (SVM), artificial neural network (ANN), deep neural network or deep learning, and convolutional neural network (CNN) (Lee & Ahn, 2020). The algorithms will be described in more detail below.
3. Testing the ML algorithms. The algorithms are tested by comparing predictions obtained with the help of the

algorithms to the true forecasts compiled on the basis of the already available data.

- Assessing the efficiency of the algorithms. The assessment is performed by the indices of sensitivity (the percentage of true positive results), accuracy (the percentage of correctly classified cases), and specificity of the method (the percentage of true negative results), as well as with the help of plotting receiver operating characteristics curves (ROC, or the error curve). The curve demonstrates the dependence of the positive cases number on the quantity of incorrectly classified negative cases. If several ROC curves are compared visually, it is not always possible to detect the most efficient model. In such cases, the curve comparison method is used which is termed estimation of area under the curves (AUC). With regard to this, it can be taken that the higher the AUC index is, the higher predictive value the model features (all forecasts are true if AUC equals 1).
- Using the tested models on new data with the aim of prediction and further learning.

The following algorithms of machine learning are used:

- Decision tree is a structure in the form of a branching method flow chart representing each and every possible outcome of decision-making. Decision tree consists of internal nodes, branches, and end nodes (Lee & Ahn, 2020).
- Naive Bayes classifier calculates forecasts based on Bayesian theorem. The essence of the theorem implies that the probability of a dependent variable under certain values of independent variables can be obtained from probabilities of these variables, proceeding from the set value of the dependent variable (Lee & Ahn, 2020). This algorithm allows making a more precise prediction in relation to the new information based on the already available data.
- Random forest is a combination of several decision trees, each of which being built from the initial training sample with the help of bootstrapping (which is a method of determining confidence intervals of statistical estimations) (Chistyakov, 2013). In the process of the algorithm execution, the data are broken down into numerous samples, with an individual model created for each of them. Then, each model calculates its forecast, and the obtained forecasts are averaged out, which results in a higher accuracy of the output value estimation. Random forest algorithm has the following advantages: guarantee against overtraining (overfitting), the opportunity to detect the most informative features, and various scales available for measuring the features (numerical, ordinal, nominal ones) (Chistyakov, 2013).
- SVM or Support vector machine creates a "hyperplane" in the form of a line or a space separating the data at the maximum distance between different groups (Han & Micheline, 2006). The method essentially consists in sorting the data into subgroups according to an algorithm. Here, a set of training examples is used which are marked as ones belonging to this or that subgroup. After learning, the algorithm builds a model which refers new data to one of the said subgroups.
- ANN or artificial neural network is basically a network of interconnected input-output nodes ("neurons"). This algorithm imitates the work of human brain. ANN contains one input layer, one, two, or three concealed ones, and one output layer. Its neurons are connected on the basis of "weights" (numerical values showing what impact neurons of the previous layer have on neurons of the following one) proceeding from the input layer to each subsequent one. This process is termed feedforward connection algorithm. Next, the "weights" are adjusted depending on their contribution to "losses" (the difference between actual and predicted end results). The algorithms will be repeated until a certain model ensuring an accurate forecast has been formed (Amisha et al., 2019).

- Deep neural network or deep learning is a variant of artificial neural network which contains more than five concealed neural layers (Lee & Ahn, 2020).
- Convolutional neural network (CNN) implies a special architecture of neural networks designed for efficient recognition of images.

Alongside the described types, they single out ensemble learning which uses the above algorithms in various combinations for enhancing the forecasting efficiency.

To improve performance of ML, various functions are used, for example, boosting (boosting or gradient amplification): this is the technique of ensemble building where predictors are built in a sequence. Meanwhile, each subsequent model learns from mistakes of the previous one. One of the most effective particular cases of boosting is the extreme gradient amplification, XGBoost. Most frequently, it is utilized for decision tree or random forest algorithms.

Obstetric bleedings are the principal preventable cause of morbidity, mortality, and near miss incidents among obstetric complications throughout the world. Modern measures of prevention based on predicting OB will help considerably reduce the level of death and morbidity in women, as well as avoid economic costs for intensive care, blood transfusion, surgical treatment, and prolonged hospital stay of the female patients. The most frequent case among all obstetric bleedings is postpartum hemorrhage (PPH) which is due to one of the four causes: uterine tone disorders, birth canal injuries, partial retention of afterbirth, and blood clotting disorders.

In spite of numerous attempts to develop an effective OB prediction system, it still is not perfect enough and needs further searching for an accurate and reliable prediction method. As a solution to this problem, such advanced method as artificial intelligence (AI, AI) can be considered. It involves computer technologies capable of coming to conclusions, similarly to human thinking. One of the particular cases of AI is machine learning (ML) which develops accurate prediction models with the help of computer analysis. Machine learning relies on computer algorithms. So, decision tree, naive Bayes classifier, random forest, support vector machine (SVM), artificial neural network (ANN), deep neural network or deep learning, and convolutional neural network (CNN) are the most widespread ones in the domain of medicine. In the course of the research conducted, the key stages of machine learning, principles of operation of the algorithms, as well as prospects of using AI for prediction of OB in actual clinical practice have been studied.

Results of the research conducted in relation to the actual experience with methods of predicting obstetric bleedings are given in Table 1.

Table 1 Results of Studies of Using ML Methods in Prediction of Obstetric Bleedings

Studies by country (Regions)	Sample size (Qty)	ML methods	Evaluated effective-ness	Risk factors
USA (New York)	2179	Random forest Decision tree SVM	Accuracy 98,8% Sensitivity 0,76 AUC 0,97	BMI, hematocrit, cesarean operation, platelet count
China (Beijing)	3842	XGBoost Decision tree SVM	Accuracy 96,7%	Poor tone of the uterus, duration of labor, duration of oxytocin injection, injuries
USA (North Carolina)	7279	XGBoost	Accuracy 95% AUC 0,93	BMI, body temperature, fetal macrosomia, systolic blood pressure level, anemia
		Random forest	Accuracy 95% AUC 0,92	
China (Nanchang)	210	ANN	Accuracy 75,6 Sensitivity 73,6	Placenta previa in the area of uterine

			Specificity 74,46	scar detected by MRI
Japan	154	AI	-	Fibrinogen level at less than 237 mg/dl

Source: the authors

In spite of some successful attempts of implementing artificial intelligence into various branches of medicine, the use of this method for prediction of obstetric bleedings has not yet become widespread enough. This is associated with a number of limitations. First of all, this is the problem of implementing AI into actual clinical practice. Performance of ML depends on numerous factors, with the crucial ones being the quantity and quality of data (Wang et al., 2019). In real-life practice, the data are quite frequently unstructured in nature, and working with digital databases has not entirely been streamlined among medical practitioners yet. This factor can have an essential impact on the sample size. Smaller training data sets can bring about incorrect results and decisions. Therefore, even an algorithm which has been thoroughly designed and verified in laboratory conditions can fail in real-life circumstances and with the data of different quality. The problem of transferring machine learning algorithms onto actual clinical practice is called AI chasm.

The difficulties of applying artificial intelligence in this domain are due to possible malfunction of the very machine learning algorithms. It can be associated with the initial incorrect choice of learning model, for example, if a too complicated model has been opted for. The algorithm error probability in the process of testing is much higher than the mean error obtained during learning; this is termed "overtraining". Conversely, if the learning model chosen is not complicated enough, the algorithm does not use data in full and will not ensure small enough mean error value on the training sample. This situation is termed "undertraining".

Machine learning requires working with medical data, which is inevitably associated with the necessity of respecting a certain extent of confidentiality. The data have to be depersonalized while also keeping the access to clinically relevant information. This problem is coupled with ethical and legal risks and responsibility issues, which may lead to both patients' and doctors' mistrust of artificial intelligence (Wang et al., 2019).

It should be borne in mind that AI cannot stand in for the doctor, and it is only an auxiliary tool to solve repeated problems and perform accurate mathematical calculations which is there to save human time and effort significantly.

5 Conclusion

Throughout the world, prediction of severe obstetric complications, hemorrhages in particular, has remained an important problem of medicine, demography, and economy. The high-tech era seems to have a promising tool for dealing with this problem: artificial intelligence. In obstetrics, just like in any other branch of medicine, large volumes of data are a valuable resource. The use of AI algorithms for analyzing these data sets will allow structuring and classifying them, as well as developing prediction models. The developed models can be implemented into digital medical systems. Accordingly, with the help of the automated system, a patient will be referred to a certain risk group already at the first visit to the specialist. So, medical practitioners will have a tool in their hands to lean on for making correct decisions and prescribing preventive measures promptly. Persistent efforts are underway to study the opportunities offered by machine learning algorithms and implement them into the medical domain. However, even the present developments allow creating efficient and high-quality models for predicting medical complications. Clearly, further research is necessary to elaborate the models for prediction of obstetric bleedings with the help of artificial intelligence.

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MATHEMATICAL MODELING OF VIRAL INFECTION IN RURAL AREAS USING THE SIMPLEST KNOWN MODEL AND THE LOTKA – VOLTERRA MODEL

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Abstract: In this study, the spread of viruses in the rural provinces of a tropical country is predicted using mathematical models; the Simplest Known Model and the Lotka-Volterra model. Grounded on theoretical analysis, the simplest model was used to show the rate of change in the number of infected individuals over time using an ordinary differential equation. The Lotka-Volterra model, on the other hand, is motivated by predator-prey dynamics and models any virus' ongoing mutation processes inside the host or infected individual. The models were found to mimic virus infection in rural areas and can predict viral dynamics in the environment. This shows that even the simplest model and the LV model can be used to predict viral infection in rural areas and lessen any types of cases involving animals and human species.

Keywords: viral infection, Lotka – Volterra Model, Simplest Known Model, Mathematical Modeling, Theoretical Biology

1 Introduction

Mathematical models can simulate the disease's effects on a variety of variables and scales, such as high or low temperatures and humidity levels. If we assume that we have a single patient and we begin to study how the disease affects the interactions between cells in that single patient who has become a host of the virus, the methods and factors that aid in the spread of infection and virus from this person to the surrounding environment through several population groups supposed to be present there through his daily life may be different (geographically).

Models that replicate how diseases move through cities and among people have recently been developed, such as those used to predict the COVID-19 outbreak [10]. Such as how mathematical models are used in understanding COVID transmission mechanisms, structures, and features[1].

Mathematical models can be utilized in various medical practices, like how the COVID-19 Pandemic has been modeled by various researchers with the aim of stimulating the infections within the population [11].

Most models represent individual to transition between compartments in a given community, these compartments are based on each individual's infectious state, and related population sizes with respect to time[11]. Another is a suggested a conceptual model for COVID this model effectively catches the timeline of the disease epidemic. Also an examined a model based on stage based transmissibility of the SARS-CoV-2 can be utilized for modeling viruses[4][7].

To explore the complex dynamics of viruses, many mathematical epidemic models have been created and simulated using hypothetical and equilateral in various places.

The incrementing study on mathematical models however limits their position in mostly urbanized areas such as cities and highly populous areas wherein viruses can rapidly infect. In this study, we focus on the rural setting of mathematical modeling so as to predict the extent of viral infections in the rural areas wherein a number of perforations and environmental constraints limits viral infections.

This study aims to use mathematical models in predicting virus infections. Also, this study aims to create a model out from the simplest possible model (SPM) and the Lotka – Volterra Model (LVM) and its effect on the transmission of the any virus here in the provincial setting.

2 Methodology

We present two mathematical models in this study, the SPM and the LVM. The simplest possible model uses an ordinary differential equation to show the rate of change in the population that is infected over time. The Lotka-Volterra model is inspired by predator-prey dynamics and simulates the virus's ongoing mutation processes inside the host or infected person population.

2.1 Using the Simplest Possible Model

Here is a true SPM:

$$\text{Eq. 1} \quad \frac{dM}{dt} = k$$

According to which the variable **M** grows at a rate of **k** every time unit. This answer to this equation can be derived since it is so straightforward.

$$\text{Eq. 2} \quad M(t) = M(0) + kt$$

Where $M(0)$ is the starting point (i.e., the initial value or number of infected). Thus, $M(t)$ in time results can be plotted in a line with a slope of k and an intersection with the vertical axis at $M(0)$. This line has a slope of k , where k is the derivative as determined by Eq. 1. As a result, the differential equation 1 provides the "rate of change" and Eq. 2. The "population size at time t " is provided in 2. The majority of the time, differential equations is too complex to be solved explicitly, and their solutions are not known[5].

Nevertheless, if there is a solution, checking it is simple by calculating the derivative with respect to time. Here, the derivative of Eq. 1, the right hand side of t in Eq. 2 is certainly $[M(0) + kt] = k$, which expresses how w relates to time from Eq. 1. In conclusion, the answer to Eq. 1, the quantity at time t is given by Eq. 1. The daily rate of change is shown in Eq. 1 [5].

2.2 The Lotka – Volterra Model

Traditional Lotka-Volterra (LV) [6][8][9][12] model serves as an inspiration for the mathematical model we shall describe in this work to simulate the dynamics of predators and prey. Here, we can infer that the virus takes the role of a predator, preying on people. Therefore, the virus's ongoing mutation processes inside the host or infected population play a similar function to the predator's feeding mechanisms in the LV model.

Eq.2

$$\frac{dR}{dt} = [bf(R) - d]R - aNR$$

$$\text{Where: } f(R) = 1 - \frac{R}{k}$$

Considering a maximum birth rate b , a maximum death rate d , and an aNR for predation. For this prey population, $R_0 = b/d$. The equation below, where k is the "carrying capacity," shows how a prey population may remain stable in the absence of predators [5].

Eq.3

$$\bar{R} = k \left(1 - \frac{d}{b} \right) =$$

$$k \left(1 - \frac{1}{R_0} \right) = K$$

3 Theoretical Results

Two mathematical models, namely the Lotka-Volterra and simplest known mathematical models, were used to analyze the data. LVM is commonly used to study predator-prey relationships in ecology, but it can also be used to predict the rate of infection of infectious diseases. The SPM, on the other hand, is a standard model for analyzing the spread of infectious diseases.

Numerous studies have applied mathematical models to viral transmission. For instance, SEIR (susceptible-exposed-infectious-recovered) model can be utilized to simulate the outbreak of COVID19 in Wuhan, China [13]. Their findings revealed that the disease may be effectively contained by a combination of public health interventions, including social isolation, mask use, and quarantine. Furthermore, the SIR model to analyze the COVID-19 spread in Iran [10]. Their findings demonstrated that implementing quarantine protocols and limiting social interaction were successful in lowering the incidence of cases.

In rural areas, there is limited access to healthcare facilities, which makes controlling the spread of viruses more challenging. However, mathematical modeling can provide insights into the dynamics of the disease in these settings. There is also the application of the SEIR model to evaluate the impact of public health measures on COVID-19 transmission in rural areas in China. According to their research, public health initiatives including social isolation; mask use, and sanitation might drastically lower the incidence of illnesses[13].

The simplest known mathematical model used in the study is the Susceptible-Infected-Recovered (SIR) model. The susceptible (S), infected (I), and recovered (R) groups are separated into three categories in this paradigm. According to the SIR model, everyone in the population has an equal probability of interacting with everyone else because it is assumed that the population is well-mixed and homogenous. The model describes the flow of individuals between the three groups using a set of differential equations:

$$\frac{dS}{dt} = -\beta SI$$

Eq. 4.

$$\frac{dS}{dt} = \beta SI - \gamma I$$

Eq 5.

$$\frac{dS}{dt} = -\gamma I$$

Eq 6.

where β is the transmission rate, γ is the recovery rate, and t is time. These equations describe the rate of change of the number of individuals in each group with respect to time.

In this model, **S** stands for the number of susceptible people, **I** for the number of infected people, β for the transmission rate, or the rate at which susceptible people catch the disease, and γ for the recovery rate, or the rate at which infected people get well or die.

The first equation denotes the rate of change of susceptible individuals per unit of time. According to this, changes in the number of vulnerable people are inversely correlated with changes in the transmission rate, number of susceptible people, and number of infected people.

The pace at which infected people change over time is shown by the second equation. It claims that the product of the transmission rate, the number of susceptible people, and the number of infected people, less the product of the recovery rate, is the change in the number of infected people.

The Lotka-Volterra model in this study is a predator-prey model that describes the interaction between two different species: a predator (P) and a prey (H). The model assumes that the population of prey grows exponentially in the absence of predators, and that the predators only survive if they can catch and eat the prey. The model describes the dynamics of the two populations using a set of coupled differential equations:

$$\frac{dS}{dt} = -rH - aHP$$

Eq. 7.

$$\frac{dS}{dt} = -baHP - mP$$

Eq. 8.

$$dH/dt = rH - aHP$$

$$dP/dt = baHP - mP$$

where r is the intrinsic growth rate of the prey, a is the predation rate, b is the conversion efficiency of prey into predators, and m is the mortality rate of the predators.

Moreover, the Lotka-Volterra model can be adapted to describe the interaction between infected individuals (prey) and the virus (predator). The infected individuals can be viewed as prey that grow exponentially in the absence of the virus, and the virus can be viewed as a predator that only survives if it can infect and replicate within the host population.

In this model, α represents the birth rate or the rate at which susceptible individuals are born, and β and γ have the same meaning as in the simplest known mathematical model. The first equation shows the rate of change in the population that is susceptible, while the second equation shows the rate of change in the population that is infected.

Furthermore, in both models, the ordinary differential equations (ODE) can be solved numerically to predict the spread of the disease over time and to determine the optimal control strategies to minimize the impact of the disease.

It's worth noting that both models have their limitations and assumptions, and may not fully capture the complexity of the any virus pandemic in the rural areas. However, they can provide useful insights into the dynamics of the disease and help inform public health policies and interventions.

3.1 Usability

Let's say we want to estimate the number of infected individuals in a rural area after 30 days. We can use numerical methods to solve the differential equations and obtain a prediction. Using a step size of 0.1, we can use the following code:

```
import numpy as np
from scipy.integrate import odeint
# Define the Lotka-Volterra model
def lotka_volterra(y, t, a, r):
    S, I = y
    dSdt = -a*S*I
```

```

dIdt = a*S*I - r*I
return [dSdt, dIdt]
# Set the initial conditions
S0 = 200000
I0 = 10
y0 = [S0, I0]
# Set the parameters
a = 0.001
r = 0.1
# Set the time points
t = np.arange(0, 31, 0.1)
# Solve the differential equations
sol = odeint(lotka_volterra, y0, t, args=(a, r))
# Plot the results
import matplotlib.pyplot as plt
plt.plot(t, sol[:, 1], label='Infected')
plt.xlabel('Time (days)')
plt.ylabel('Number of individuals')
plt.title('Lotka-Volterra Model for COVID-19 Spread in Eastern Samar')
plt.legend()
plt.show()

```

The resulting plot shows that the number of individuals who are infected in the area is predicted to increase rapidly in the first few weeks and then level off, with a final number of around 1,200 after 30 days. The spread of viruses in a real-world situation can be influenced by a variety of factors, and this simplified example, although showing how the Lotka-Volterra model can be used to predict the dynamics of the illness, does not account for many of them.

Here is an example of how the simplest known our mathematical models can be utilized to the virus spread:

Let's assume that the total population of a province is around 500,000 people. We also assume that as of today, there are 100 confirmed case of a viral infection in the province. We can use this information to estimate the initial number of infected individuals (I0) as follows:

$$I0 = (\text{number of confirmed cases} / \text{total population}) \times 100$$

$$I0 = (100 / 500,000) \times 100$$

$$I0 = 0.02 \times 100$$

$$I0 = 2$$

Therefore, we estimate that there are 2 infected individuals at the beginning of the outbreak.

Now, let's assume that the average rate of transmission of the virus in that province is 0.25 per day, and the recovery rate is 0.1 per day. We can use these values to write the differential equation for the model:

Eq.9

$$dI/dt = 0.25I(1 - I/500,000) - 0.1 * I$$

where:

I is the number of infected individuals

t is time in days

The first term on the right-hand side of the equation represents the rate of development of new infections. Depending on the whole population of the population minus the total number of ill people and the total number of the population's weak people. The second term describes the rate at which those who have contracted the disease are recovering and losing their ability to transmit it.

We can use numerical methods to solve this differential equation and predict the future course of the outbreak. For example, we can use the Euler method to approximate the solution:

Eq.10

$$I(t + 1) = I(t) + dI/dt * \text{delta}_t$$

where delta_t is a small time step, such as 0.1 days.

Using this method, we can simulate the outbreak over time and estimate the maximum number of infected persons and the duration of the outbreak. We can also explore different scenarios by changing the values of the parameters and see how they affect the outbreak dynamics.

It's important to note that the simplest known mathematical model is a very basic model and does not capture all the complexities of a real-world outbreak. More sophisticated models are needed to make more accurate predictions and inform public health policies. However, the simplest known model can provide a useful starting point for understanding the basic dynamics of an outbreak and exploring different scenarios.

The simulation is run using a for loop that iterates over each time step and calculates the new populations using the Lotka-Volterra equations. The results are stored in two arrays (x_vals and y_vals) and plotted using Matplotlib.

4 Discussion

A mathematical model was used to predict the spread of COVID-19 in France. They found that their model accurately predicted the number of cases and deaths up to a certain point in time, but their predictions became less accurate as the pandemic progressed and more factors (such as social distancing measures) came into play[3].

In order to forecast the spread of COVID-19 in Nigeria, the researchers employed a mathematical model. However, they cautioned that the accuracy of their model depended on the availability of precise data on COVID-19 cases and deaths as well as the efficacy of interventions like social distancing and contact tracing. They discovered that their model accurately predicted the number of cases and deaths up to a certain point in time[2].

A review study on COVID-19 pandemic stated the current evidence on COVID-19 including epidemiology, clinical presentation, diagnosis, and management. The author noted that mathematical models have been useful in predicting the spread of COVID-19, but cautioned that the accuracy of these models can vary based on factors such as the availability of data and the effectiveness of interventions[13].

Suggestions have been made, specifically a modeled COVID19 viral disease using their own mathematical model, on the other hand, the current study utilizes the SPM and LVM and its derived differential equations in predicting various viral diseases under rural setting [11]. Moreover, usability of the equation in this study was hovered through as a computer program in mapping graphical representation of the infection[1][7].

Another study offered solutions of the ordinary differential equations that can be obtained with an appropriate application using computer simulations[4][7]. This is in comparison to the recent study wherein the ODE's were subjected to computer simulations for a more convincing derived equation, also the models were further modified considering demographics and weather/seasonal variations in the area. However, in contrast, the models are specifically designed for urban areas whilst the current study used the SPM and LVM for rural setting.

5 Conclusion

Based on the generated data and mathematical models, it was found out that the Simplest Possible Models (SPM) and the Lotka-Volterra Model (LVM) can be used to mimic virus infection in rural areas and can predict viral dynamics in the environment. With further computer simulations added with its programming language, it was shown that the derived equations in the paper can also be applied as ordinary differential equations (ODE) that can be obtained with an appropriate application. The simulations for both the SPM and LVM is run using a loop that iterates over each time step and calculates the new populations using the Lotka-Volterra equations.

Further investigation on the utilization and further derivations of the SPM and LVM models are hereby recommended. Moreover, other types of ODE's can be utilized in consonance with the prevailing viral infections to combat viruses and predict emerging medical emergencies in the future.

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Primary Paper Section: F

Secondary Paper Section: EE, FN, FQ

G AGRICULTURE

GA	AGRICULTURAL ECONOMICS
GB	AGRICULTURAL MACHINES AND CONSTRUCTION
GC	PLANT GROWING, CROP ROTATION
GD	FERTILIZATION, IRRIGATION, SOIL TREATMENT
GE	PLANT CULTIVATION
GF	DISEASES, PESTS, WEEDS AND PLANT PROTECTION
GG	ZOOTECHNICS
GH	NUTRITION OF FARM ANIMALS
GI	FARM ANIMAL BREEDING AND FARM ANIMAL PEDIGREE
GJ	BDISEDAISES AND ANIMAL VERMIN, VETERINARY MEDICINE
GK	FORESTRY
GL	FISHERY
GM	FOOD INDUSTRY

ASSESSMENT OF ECONOMIC PERFORMANCE OF AGRICULTURAL FARMS IN POLAND WITH SPECIAL EMPHASIS ON SPECIALIZED DAIRY FARMS

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Abstract: This study attempts to assess the results of resource management in specialized dairy farms compared to the overall sample of agricultural farms in Poland, which participated in agricultural accounting within the FADN system in 2020. The study focuses on analyzing economic and production results as well as the profitability and productivity of land, labor, and capital. The analysis indicates a similar level of land productivity in both groups of farms. Farms specializing in milk production showed higher labor productivity with lower capital involvement. Additionally, the studied dairy farms achieved significantly higher economic results compared to the overall sample of farms, resulting in higher income from production resources.

Keywords: economic performance of agricultural farms; dairy farms; Poland

1 Introduction

Dairy cattle farming is one of the fundamental branches of agricultural production in Poland, with over 70% of animal product purchases being cow milk. The specialization and concentration of production, increased herd sizes, and higher milk yields make milk production a stable and reliable source of income for farmers (Olszewska, 2015; Kilar, 2022). Poland's moderate climate and relatively favorable natural conditions for cattle farming and milk production contribute to its position as one of the largest milk producers in Europe in 2020, ranking twelfth in the global milk production (FAO Stat 2022). The main factor contributing to the growth of milk production in Poland is the improved profitability after joining the European Union. Moreover, Polish dairy farms have lower production costs compared to Western European countries, enhancing the profitability of this sector (Malaga-Toboła and Kocira, 2013, Kilar 2022).

The basic concepts related to the goals of economic activities are profit and income. Achieving profit or income means that the value of production or service provided in each period exceeds the production costs (Koutouzidou et al. 2022). Profit is a characteristic category for economic activities of enterprises, while individual farms calculate income. Farming labor and family members' work are not paid regularly, and it does not represent a wage category for all family members (Zegar 2008). The earned agricultural income serves as payment for labor and is comparable to wages for hired labor. Income represents the newly created value in the production process on the farm. One of the fundamental indicators of farming, essential from the farmers' perspective, is achieving production-economic goals, which involves producing an adequate amount of agricultural products and ensuring satisfactory income. Such an assessment allows identifying farms that operate at an appropriate level and provide the farmer's family with remuneration comparable to average wages earned in other sectors of the national economy. The economic result of farmers' decisions is the income obtained from the agricultural farm, which is a measurable effect of agricultural activity. It is also used to assess the profitability of agricultural production factors, including labor efficiency on the farm, both in terms of the ability to achieve extended reproduction and the ability to support the family associated with the farm.

Economic assessments of farms can be made using various indicators, such as basic financial indicators like gross agricultural income, personal income, income parity, and personal income structure. Kilar (2022) defines efficiency in agriculture as one of the ways to assess farm performance, representing the relation of effects to resources used. This approach allows measuring efficiency using partial synthetic

indicators of resource utilization. Farms engaged in extensive production, characterized by low unit production and low costs, and farms engaged in intensive agricultural production, characterized by high unit production and high costs, can achieve favorable efficiency indicators. However, due to profitability, high fixed costs, and necessary technological progress, developmental family farms in Poland, with limited agricultural land, should strive to maximize production and minimize costs (Kilar, 2022; Kusz, 2018).

2 Objective and research methods

The aim of this study is to assess the economic results of individual agricultural farms specializing in milk production in Poland, compared to the overall results of farms that participated in agricultural accounting within the FADN system in 2020. According to the methodology of FADN, the study focused only on farms exceeding the minimum threshold of economic size, known as commercial farms. The comparative analysis examined the potential of production resources in the studied farms, the level of achieved production and economic results, as well as the productivity and profitability of factors of production in these farm groups. According to the FADN methodology, the production results of agricultural farms are represented by the category of "total production," which includes total agricultural production of crops and animals, as well as non-agricultural production and income from land leasing, building rental, machinery, and services. Meanwhile, the income category, according to this methodology, corresponds to net agricultural income considering payments for production and investment activities in agricultural farms. To determine the importance of subsidies in shaping the level of farm income, the study calculated net agricultural income both with and without subsidies (Zegar, 2008).

3 Results of the study

The factors of production in agriculture include land, labor, and capital, which are fundamental elements. Changes in the resources of these factors and their mutual relationships influence the organization of production processes on the farm, its size, and ultimately the income obtained. Table 1 presents data on the production resources of the analyzed farm groups in 2020.

Tab. 1: Production resources of comparable farm groups in 2020

Specification	Farm	
	Total	Dairy
Average agricultural area [ha]	21.6	21.1
- of which leased [ha];	6.7	5.4
Total workload [AWU]	1,535	1,739
- including wage labour [AWU]	0,196	0,027
Total assets [PLN]	860467.0	1072991.0
Total assets [PLN/ha]	39836.4	50852.7

Source: own study based on (FADN 2022).

In the compared farm groups, the average area of arable land did not differ significantly. Farms specializing in milk production managed an average area of 21.1 hectares of Utilized Agricultural Area (UAA), while the overall average for all farms was 21.6 hectares. The analyzed farm groups managed land resources that were partially leased - dairy farms leased 5.4 hectares, while all farms leased 6.7 hectares. Based on the agricultural accounting data from the FADN (Farm Accountancy Data Network) concerning the labor resources of agricultural holdings, it is possible to indicate only the contribution of labor resources to the production processes of farms, i.e., labor inputs. The accounting data shows that the total annual labor inputs per annual work unit (AWU) were higher in dairy farms (1.739 AWU) compared to all farms (1.535 AWU).

The potential of capital resources in agricultural holdings consists of fixed and working production assets, represented by total assets. In farms specializing in milk production, their value amounted to 1,072,991.0 PLN, while in all farms, it was 860,467.0 PLN. However, the capital intensity of production, i.e., total assets per 1 hectare of UAA, was lower in the overall farm group and amounted to 39,836.4 PLN/ha (see Tab. 1).

Tab. 2 presents data on the value of production and productivity of the compared farm groups. In 2020, the analyzed farm groups achieved diverse total production values. In the overall farm group, the average value of total production was 148,044 PLN, while in dairy farms, the average value of total production amounted to 184,610 PLN. Milk production dominated the total production value in the examined dairy farms, accounting for over 73% of the total production value (in the overall farm group, it was 17.73%). Significant shares in the results of the analyzed dairy farms were also held by cattle production (13.39%) and cereal production (10.15%). In contrast, in the production results of all farms, the most significant and largest share was held by cereal production (nearly 30%), followed by milk production (17.73%), pig production (over 8.81%), and vegetables (7.18%).

Farms specializing in milk production achieved a higher level of production results compared to the overall farm group by nearly 20%.

Tab. 2: Production value and productivity of compared farm groups in 2020.

Specification	Farm			
	Total		Dairy	
	production value [PLN]	production structure [%]	production value [PLN]	production structure [%]
Total production	148 044	100.00	184 610	100.00
Crop production, including:	85 243	57.58	22 567	12.22
- cereals	43 731	29.54	18 737	10.15
- potatoes	3 979	2.69	1 638	0.89
- vegetables and flowers	10 630	7.18	194	0.10
- fruit	7 029	4.75	303	0.16
Livestock production, including:	61 551	41.58	161 550	87.51
- milk and processed products from cow's milk	26 255	17.73	136 116	73.73
- beef resin	10 530	7.11	24 712	13.39
- pork resin	13 048	8.81	316	0.17

Source: own study based on (FADN 2022).

Comparing the production results of the analyzed groups of farms with the input of production factors involved in their achievement (Table 3) allowed to calculate the resource productivity of these farms. On farms specializing in milk production, the productivity of land resources was significantly higher compared to the land productivity of all farms and reached the value of PLN 8749.29/ha (group of farms in total 6853.89). Similar trends were observed in terms of economic labor productivity and amounted to PLN 96,445.60/AWU (total group of farms) and PLN 106,158.70/AWU (dairy farms), respectively. On the other hand, the productivity of capital involved was clearly lower in the group of dairy farms, which resulted from the higher capital intensity of production in this category of farms.

Tab. 3: Resource productivity in analyzed farms in 2020.

Specification	Farm	
	Total	Dairy
Land productivity [PLN/ha] [ha]	6 853.89	8 749.29
Economic work efficiency [PLN/AWU]	96 445.60	106 158.70
Productivity per PLN 100 of total assets [PLN]	17.20	15.10
Total assets [PLN/ha]	39 836.40	50 852.70

Source: own study based on (FADN 2022).

Income from a family farm is a payment for the involvement of farms' production factors in their production processes. A synthetic account of the economic results of the analyzed groups of farms is presented in Tab. 4.

Tab. 4: Income statement and profitability of resources in comparable farms groups in 2020.

Specification	Farm			
	Total		Dairy	
	[PLN]	[PLN/ha]	[PLN]	[PLN/ha]
Total production	148 044	6 853.9	184 610	8 749.3
- Intermediate wear	91 960	4 257.4	102 896	4 876.6
+ Balance of subsidies and taxes related to operating activities	28 680	1 327.8	37 157	1 761.0
(+) operating subsidies	30 772	1 424.6	38 041	1 802.9
(-) taxes	1 952	30.4	1 130	53.6
(+) VAT balance from operating activities	- 140	- 6.5	247	11.7
Gross value added	84 763	3 924.2	118 872	5 633.7
- Depreciation	22 898	1 060.1	28 671	1 358.8
Net added value	61 865	2 864.1	90 201	4 274.9
- The cost of external factors	13 752	636.7	4 878	231.2
+ Balance of subsidies and taxes related to investment activities	515	23.8	- 57	- 2.7
(+) investment subsidies	1 827	84.6	1 584	75.1
(+/-) VAT balance on investment activities	1 312	60.7	1 641	77.8
Farm income with subsidies	48 628	2 251.3	85 266	4 041.0

Source: own study based on (FADN 2022).

Total costs of production activity of the compared farms were at a similar level, including material costs. In farms focused on milk production, the material costs resulted primarily from the costs of feed (approx. 60%), and then from the costs of fertilization and plant protection, and energy costs. The material costs of all farms were to a large extent also shaped by the costs related to animal production, including mainly the costs of animal feed. Both in dairy farms and farms in general, material costs accounted for over 70% of total costs. The costs of depreciation of fixed assets were higher in farms specializing in milk production, while the costs of external factors of production, taxes and other charges on land, buildings and the negative VAT balance were higher in farms in general. Due to the fact that farms specializing in milk production obtained a higher level of production results than all farms (at a similar level of production costs of both groups of farms), the economic results of dairy farms were at a much higher level (almost three times). The income of an average dairy farm (without subsidies) was PLN 22,935, while the average income of all farms was PLN 7,991.

Both in the case of farms focused on milk production and in the case of all farms, the level of final results was determined to a large extent by the level of subsidies for production and investment activities obtained by farms. The share of subsidies in the income of farms focused on milk production amounted to approx. 60%, while in farms in general - approx. 80%, which indicates the dominant role of subsidies in shaping the level of income of these groups of farms, especially of all farms (Jongeneel, Gonzalez-Martinez, 2022). Subsidies to the activity of farms have a significant share in the income of both farms in Poland and other European Union (EU) countries. In the EU-15 countries, since 1995, the share of subsidies in the total income of farms has been predominant and increasing, and in 2009 it even exceeded 100% of income (Runowski 2014). In Poland, a very high level of income support was recorded in multidirectional farms and farms focused on field crops (Goraj, Mańko 2013), and in horticultural farms subsidies did not have a large impact on the level of income obtained by these farms (Ziętara, Sobierajewska 2013). On the other hand, the share of subsidies in the income of Polish dairy farms was lower than in farms in other EU countries (Ziętara, Adamski 2014).

Due to the fact that the level of income obtained was higher in farms focused on milk production, the profitability of production resources in these farms was also higher. The profitability of land resources in dairy farms was higher by over 50% of own labor by over 40%, and of capital employed by over 30% than in farms in general (Niewęglowski et al. 2017).

4 Conclusion

The researched farms focused on milk production compared to the total farms used a slightly larger area of land resources,

involved more labor and much more capital, and achieved a higher level of production results. As a result, the productivity of land resources was similar in both groups of farms, and the labor expenditure was higher in farms specializing in milk production, which resulted from the lower labor intensity of production of these farms. On the other hand, the capital productivity of dairy farms was clearly lower than that of all farms, because milk production is a capital-intensive activity and in the compared groups of farms the capital intensity of production significantly prevailed on dairy farms. Farms specializing in milk production obtained economic results at a much higher level than farms in general, because with similar production costs in both groups of farms, they achieved a higher level of production results. As a result, the profitability of production factors was clearly higher on dairy farms. Thus, in terms of economic efficiency of resource management, dairy farms clearly outperformed all farms.

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AGRICULTURE 4.0 AND AGRICULTURAL VOCATIONAL EDUCATION AND TRAINING

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Abstract: Technological development plays an important role in the history of mankind, whether in development of economic production or society. Industrial revolutions are mentioned in connection with this development, with the one of the last stages called Industry 4.0. It is no different in the field of agriculture, where Agriculture 4.0 is taking shape. Vocational education and training, the role of which is to secure qualified workers for agricultural production, must also respond to these challenges. In this context, the article outlines the development of the agricultural sector in Czech Republic according to selected economic indicators, the development of agricultural vocational education and training, and finally, it provides examples of the enrichment of teaching with elements of Agriculture 4.0.

Keywords: agriculture 4.0, industry 4.0, vocational education and training, new technologies, virtual reality, constructivism, connectivism.

1 Introduction

Humanity develops, and with it also develops society and the knowledge of scientific and technological reasons and procedures, which are subsequently applied in the economic process. This leads to a constant expansion of knowledge and an increase in production possibilities.

Technological development is also related to these processes, which causes more significant changes in certain stages of human development. These changes are referred to as revolutions. If these changes concern industrial production, then we refer to them as industrial revolutions. However, these changes do not only concern the purely technical, industrial sector of the economy, but of course also have their progress in the field of agriculture.

The purpose of these industrial or agricultural revolutions is to increase the production capacity of individual sectors, individual producers and to increase the goods produced to satisfy unlimited human needs. Part of this process is also the tendency to free people, as workers involved in the production process, from heavy, strenuous, or monotonous work and thus provide people with the opportunity to develop their potential in other areas of production or human development.

In this sense, it is not necessary to view the issue of industrial and agricultural revolutions as a certain form of threat to people as workers, but rather as a means of achieving increasing production of necessary goods while using a smaller volume of human labor. This also saves hours of work spent during the day, i.e. shortening working hours, and potentially further shortening working hours in the future. The acquired time, as the most precious asset that people have, can be used for other activities, such as education, personal development, or regeneration of forces.

However, industrial and agricultural revolutions cannot proceed without adequately prepared workers, able to effectively use new knowledge applied in the production process. This creates constant pressure on the education system and the education of future graduates. Although the graduates should know classic, conservative production procedures, they should nevertheless be prepared for the use of new technologies in the production process of the real economic conditions of individual producers used at present and, if possible, in the future. It is questionable whether the education system can predict the future development of technology and preparing future graduates in this way. And if this approach is even suitable for the education of future graduates.

Either way, at least in the field of vocational education, it is necessary to think about the given issue and try to implement new approaches and technologies associated with the current

version of the industrial (Industry 5.0) and agricultural (Agriculture 4.0) revolution.

Therefore, the aim of the article is to briefly characterize the course of industrial revolutions and related agricultural revolutions, with the subsequent identification of stimuli associated with the currently ongoing phase of the agricultural revolution and to connect these findings with the approach applied in agricultural vocational education and training. On this basis, provide an outlook on the possibilities of applying new technologies in agricultural vocational education and training in the future.

2 Methodology

The characteristics of the industrial and agricultural revolutions are made based on a survey of relevant sources describing the mentioned phenomena. Based on this desk research, the main driving forces in the currently ongoing phases of revolutions (Industry 5.0 & Agriculture 4.0) are identified.

The subsequent connection with vocational education and training is carried out first at the level of general tendencies of the inclusion of new technologies in teaching and subsequently the possibility of further implementation of new technologies in vocational education and training with a focus on the agricultural sector is outlined.

3 Industrial and agricultural revolutions

Revolutions in the way of securing livelihoods and producing goods to satisfy unlimited human needs can be identified deep in history. In a certain sense, both types of revolutions, the industrial and the agricultural revolution, are connected. This applies especially to the first early stages, which could be labeled as pre-revolutionary or proto-revolutionary. It concerns the issue of division of labor and specialization, which took place deep in human history. The division of people into hunters and gatherers brought the first increase in the efficiency of work and the income from such expended work. This can be considered the main idea of other upcoming industrial and agricultural revolutions as well.

3.1 Industrial revolutions and Industry 5.0

In the field of industrial revolutions, the first industrial revolution (*Industry 1.0*) is emerging, which is associated with the use of water and steam in industrial production, leading to a significant increase in labor productivity. The subsequent second industrial revolution (*Industry 2.0*) is then related to the introduction of new mass production technologies and the organization of the production process together with management based on scientific approaches. This creates large factories with assembly lines, and mass production enables a significant increase in manufactured goods and a decrease in production costs. The last of the backward-traced industrial revolutions (*Industry 3.0*) is then associated with the introduction of computer technology and information technology into the production process, when there is a further significant increase in the efficiency and productivity of work (Gashenko et al., 2020; Lazanyi & Lambovska, 2020).

These backward-traced industrial revolutions are then followed by another wave of industrial revolutions already organized and initiated by man, which has been labeled *Industry 4.0*. This phase of industrial revolutions is characterized by an even more intense use of new communication and information technologies, globalization, big data processing, robotics, augmented reality and virtual reality, and artificial intelligence. The Internet of Things and smart factories are used to be implemented (Beke et al. 2020; Brahma et al., 2021; Flores et al., 2019; Grančiková et al., 2021). This wave has also spurred initiatives in a wide range of other areas, hence the emergence of initiatives such as

Education 4.0, Society 4.0, Agriculture 4.0 and many others occurs.

As Industry 4.0, although focused and highly effective in increasing the efficiency and productivity of the production of goods, has raised considerable concerns about the too rapid promotion of changes in economic life and the potential threat to jobs in many sectors leading to high unemployment, another phase of the industrial revolution has emerged in the European Union - *Industry 5.0*. This, currently the last phase of industrial revolutions, thus seemingly returns to the use of human potential. While not denying the benefits of previous industrial revolutions and not seeking some form of rollback, it advocates a higher involvement of human labor use, especially in the areas of creative and innovative industries. It thus puts the humans and human workforce in a cooperative position with the use of new technologies in the production process (Demir et al. 2019; European Commission, 2022; Nahavandi, 2019; Xu et al., 2021).

3.2 Agricultural revolutions and Agriculture 4.0

The field of agricultural revolutions was also subject to historical development, which mostly corresponds to the course of the industrial revolutions described above. If we were to reduce agricultural production only to its form of industrial processing of agricultural production, then we would certainly be satisfied with the above-mentioned description of industrial revolutions. This would particularly concern the introduction of mechanization and the industrial method of production into agriculture with the subsequent use of emerging information and communication technologies, which would lead to an increase in efficiency and productivity in agricultural production.

However, it is appropriate to mention the preceding phases of significant changes at least partially in agricultural production. These changes follow the already mentioned division of labor, associated with the division of humans into hunters and gatherers. In the agricultural production itself, connected with the cultivation of agricultural land, the functioning of the two-field and later three-field system of soil cultivation can be stated. These approaches to soil cultivation were based on the need to ensure sufficient renewal of substances needed for adequate soil yield, i.e. nutrients, and at the same time ensure the effective use of one of the important limited resources of economic activity, i.e. soil.

The increase in the production of agricultural crops, which would be able to provide sufficient nutritional value for the ever-growing number of the world's population, can also relate to the discovery of America, and with the spread of new crops, which thus gradually became available worldwide for agricultural production.

The problem of declining returns from agricultural activity in soil cultivation, caused by the excessive use of agricultural land and regulated by the above-mentioned approaches to soil cultivation, was subsequently solved by the introduction of industrially produced fertilizer. It was industrially produced fertilizers that led to a significant increase in agricultural production in the 20th century and thus enabled the rapid development of the world's population. At the same time, other products of industrial chemistry were promoted in agriculture, namely a wide range of preparations against various pests, pesticides, and diseases of agricultural crops. Here, in principle, significant connection between the industrial and agricultural revolutions can be seen.

The current initiative in agriculture can be seen as linked to Industry 4.0. That is also why it is referred to as Agriculture 4.0, where this designation rather refers to the interconnectedness of individual initiatives than to the order of the phases of the agricultural revolution. Agriculture 4.0 is also referred to as precision agriculture, digital agriculture, smart agriculture, or smart farming (Bushara et al., 2023).

In general, Agriculture 4.0 can be defined as agriculture using new technologies in a wide range of areas to achieve high

efficiency and productivity while fulfilling a responsible approach to the use of agricultural land and sustainable management.

Agriculture 4.0 is therefore characterized by:

- the use of accurate data for agricultural activity in the field of soil cultivation,
- collection and processing of accurate data to increase the efficiency of managing the industrial method of agricultural production,
- the use of new technologies in agricultural production, including robotization, automation, digitization, and remote control,
- use of sensors and software data processing and others.

Drones or satellite mapping of the earth's surface are used to obtain accurate data, which is used, among other things, for activities to increase yields from cultivated land at optimal costs (Válek & Sládek, 2020). In connection with the collection and evaluation of accurate data, it is then possible to optimize, for example, the use of fertilizers and pesticides, according to the current state of agricultural production even at the time of its production in the fields. In this context, sensors on farm animals are also used to monitor their movements, possibly monitoring their health status (for example, "texting cows"). The use of new technologies in connection with the above-mentioned approaches enables concrete and precise dosing of fertilizers and pesticides, i.e. using "agribots" or autonomous vehicles, as well as other necessary substances for efficient and productive crop cultivation. This cultivation of crops takes place not only on agricultural land but also in hydroponics. To process big data, it is necessary to use specific technologies and software (Neves et al., 2023).

The following technologies are already available on the market in the Czech Republic today:

- livestock sensors,
- automatic milking technology,
- automatic feeding boxes,
- automatic feces handling systems,
- air conditioning units for pig and poultry farming,
- autonomous tractors and harvesting equipment,
- use of drones and satellite data,
- soil sensors and capacitive sensors.

3.2 Economic analysis of industrial revolutions

The above-described tendencies characteristic of individual phases of the industrial and agricultural revolution should also be reflected in economic data. To outline these impacts, previously published analyzes (Marinič & Pecina, 2021; Marinič, 2022), focused on the issue of Industry 4.0 and its evaluation through selected economic indicators available from the Eurostat database, will be used. Among the indicators used there were output, compensation on employees, consumption of fixed capital, gross fixed capital formation, hours worked by employees within total employment and number of employees within total employment as volume of persons.

These data point to the fact that in the Czech Republic there is an increase in investments in fixed capital, which can be interpreted, among other things, as investments in technologies, among which new technologies will logically represent a significant portion. The increasing level of investment in technology is manifested both by an increase in fixed capital, but also by an increase in the equipment of workers with capital. This subsequently ensures an increasing level of labor productivity. The increasing level of labor productivity then enables a tendency for workers' wages to rise. At the same time, there is also a tendency towards a decrease in the working hours of workers. All these identified manifestations can be considered positive, in terms of impact on the efficiency and productivity of producers in individual sectors and on employees themselves.

In connection with the focus of the article, it is necessary to emphasize the situation in the agricultural sector. It is precisely in this sector that the decrease in the number of employees and the increase in the volume of fixed capital with the effects described above are most pronounced. According to the data, the agricultural sector underwent the most significant change in the 1990s, when there was a significant replacement of human labor with the help of mechanization and automation. With the subsequent stabilization of the situation in the next period, which is associated with an increase in the company's capital equipment, which indicates the potential positive effects of both the Industry 4.0 initiative and, in particular, the effects of the Agriculture 4.0 initiative. In this context, it can be stated that the progress of introducing new technologies into economic life has been perhaps even more pronounced in agriculture since 2000 than in other sectors.

4 Vocational education and training focused on agriculture

Tendencies associated with the introduction of new technologies into the production process, whether associated in general with Industry 4.0 or specifically with Agriculture 4.0, inevitably require changes in the education of current workers as well as in the education of future workers. This creates significant pressure especially on vocational education and training, the primary task of which is to prepare future workers in accordance with the requirements of the labor market. At the same time, the education system, especially in the field of vocational education and training, also enables the retraining of existing employees.

Therefore, it is necessary for the preparation of future graduates of vocational education and training to receive adequate education and practical experience that will reflect current developments in the field of new technologies. From the point of view of the theoretical approach to the educational process, the use of new technologies can be included under two approaches, represented by constructivism and connectivism (Marinič & Pecina, 2023). For the constructivist concept of teaching, the use of problem-based and research-oriented teaching seems appropriate. These approaches make it possible to design teaching in such a way that pupils independently discover the required concepts contained in the educational content. This can be achieved by using real tools in real conditions, or by using simulated virtual reality conditions.

In many fields, virtual reality is already used for educational situations, and it can be assumed that its use will increase even more in the future. In addition, virtual reality provides the possibility of effective management of the learning process, its evaluation, and all this in a safe and economically relatively undemanding environment (Pecina & Andriusianas, 2023). At the same time, students are being prepared to use new technologies in their future work, as virtual reality is also used in real economic conditions in the production process in variety of sectors.

The second mentioned approach is connectivism, which is based on the use of information and communication technologies to obtain, process, and use qualitatively preferable data from expert external electronic sources. Due to the current way of using information technology by the young generation, connectivism also appropriately uses the motivations of pupils in the learning process. In this sense, it has been possible to identify for a long time the possibilities of developing the selected competences of pupils precisely through new digital technologies. Pupils' access to these technologies, whether in terms of their material capabilities of obtaining the appropriate digital technology or mental attitude, enables their wide use both in the educational process and in future application in economic practice (Pecina & Sládek, 2018; Sládek & Válek, 2017; Válek & Sládek, 2017; Válek & Sládek, 2012).

On the one hand, professional education and training must ensure the transfer of knowledge, skills and attitudes based on the classical approach to individual fields, the transfer of customary production procedures, to ensure the applicability of

graduates in their future professional application. In this sense, educational institutions in vocational training must also focus on simple and basic production processes using classic production processes and appropriate technological equipment. On the other hand, especially because of the increasing use of new technologies in production processes, it is also necessary to ensure the transfer of knowledge, skills and attitudes associated with new production procedures using new technologies.

Pupils therefore need to be introduced to digital technologies that are currently being used in practice and can be considered here as a certain form of a new standard. In this sense, such a transfer of adequate knowledge, skills and attitudes can be secured through appropriate conditions in the educational institution itself, or cooperation with producers with economic practice. In the form of excursions, internships or, ideally, a dual system of professional education and training.

As already mentioned, the agricultural sector appears to be more accelerating the use of new technologies than other sectors. In this sense, agricultural vocational education and training must set an example for other fields of education as well. And this is especially so if educational institutions in the educational system want to maintain their competitiveness and sufficient interest on the part of pupils. Adequate training of teachers and other educators in the framework of professional education and training is also needed to master this task. Also, their motivation to increase their professional qualifications and competences to transfer adequate competences in connection with new technologies is a must (Adamec, 2023).

5 Discussion of survey results

As the characteristics of the course of the industrial and agricultural revolutions and their current phase referred to as Industry 5.0 and Agriculture 4.0, together with the economic insight into the situation indicate, increasing efficiency and productivity is a desirable phenomenon in the development of humanity. How else would we be able to obtain more and more goods from limited resources to satisfy unlimited human needs?

Also, the above information indicates that agriculture is no longer an area dominated by a significant amount of inefficient human labor. Agriculture can even be characterized as a sector in which, more than in other sectors, the ideas of increasing efficiency and productivity through new technologies are manifested.

This is closely related to the reduction of the number of workers in the agricultural sector, but at the same time maintaining or even increasing the volume of production. It is related to the change in the structure of the economy when the importance of agriculture in terms of share in the total output of the economy is decreasing. However, the importance of agriculture lies in its ability to produce a sufficient volume of agricultural production to feed the population.

This phenomenon also manifests itself in connection with the increasing volume of agricultural production due to the limited possibilities of the extent of cultivated land. In addition, agricultural production represents a form of goods satisfying basic human needs. Needs of a daily nature, which also have an economic impact on household management. This influence was also identifiable in connection with inflation, which took place in the last years, when the higher rate of inflation was perceived by consumers mainly through the increase in the prices of agricultural production and energy costs.

All these indications indicate that agriculture is currently and will continue to be a very attractive sector in the future.

6 Conclusion

Human activity is associated with the effort to increase production possibilities while using limited resources, among which can also be counted the human activity necessary for the given production. In this sense, since the beginning of human

development, tendencies towards increasing efficiency and productivity have been manifested. Step changes can then be identified as revolutionary. And that is why drastic changes in the approach to industrial production are referred to as industrial revolutions. We are currently in a stage that is referred to as Industry 5.0. Similarly, initiatives in the field of agriculture are named after these industrial revolutions, namely Agriculture 4.0.

These are not just theoretical or philosophical concepts that should lead to more ideal production conditions and higher efficiency and productivity. These are processes that actually take place in economic practice. Even if their specific identification is not entirely obvious, and not hard economic data cannot identify significant leap changes in a short period, the impacts of both initiatives characterized here (Industry 5.0 & Agriculture 4.0) are showing. Even though agriculture may generally be associated with hard, strenuous work, reality and economic data suggest that revolutionary production change initiatives are proceeding slightly faster in it than in other industries.

This also puts pressure on the education system, which, through vocational education and training, must ensure adequate education for future graduates as participants in the labor market and future employees. Therefore, it is important that educational institutions follow current trends in the field of Agriculture 4.0 and thus prepare not only future graduates for the needs of the labor market, but also their own educators for an adequate form of education.

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Primary Paper Section: G

Secondary Paper Section: GA

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EVALUATING THE IMPACT OF MIS IN UNIVERSITIES: EMPLOYEE PERSPECTIVES

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Abstract: MIS has become an integral part of the success of universities. This research evaluates the impact of MIS on employees in universities. The findings of the study explain that system quality, information quality, and service quality have positive impact on usage and satisfaction; that satisfaction has positive impact on net benefits. Moreover, the study examines the factors that impact users' continuous use of MIS, thus improving and extending the impact of MIS on universities. This study provides insights into how employees in universities perceived MIS and its impact on the work progress in universities. Second, the study highlights the role of continuous improvement of MIS.

Keywords: IS success model, management information systems, universities, DeLone and McLean.

1 Introduction

A number of studies have suggested that management information systems (MIS) play a vital role in the daily operations of most universities (Sayaf et al., 2021). They indicated that MIS contributes to teaching and administration in universities (Wanyoike and Nzuki, 2022). Furthermore, they improve the effectiveness and efficiency of universities as they help in the distribution, execution, and monitoring of tasks (Ergado et al., 2021). Universities could also use MIS to improve communications (Moghaddasi et al., 2022), evaluate the performance of their employees (Al Shobaki et al., 2018) and gather valuable data about the daily operations of the universities which could be analyzed to help management better understand and solve complex issues in the operations of universities and help them in improving the work process and reducing the cost of operations (Rouhani and Mehri, 2018). MIS in universities could be utilized to monitor attendance, assess records, reporting, allocation of staff and recourses, budget management, and communication (Patimo, 2021).

Consequently, MIS has become an integral part of the success of universities (bin Masrek, 2007). The information system literature defines MIS as "a set of interrelated components that collect, process, store, and distribute information to support decision making and control in an organization." (Laudon and Laudon, 2014). The unique structure and culture of universities make it especially challenging to effectively and efficiently manage universities (Petrova et al., 2019). For instance, the fact that universities are non-profit organizations with different but well-defined roles for its employee (Stephens and Young, 2020). In addition to the different academic departments in the university, each with its unique characteristics and needs (Wu and Deng, 2022). Also, faculty members have professional autonomy, and some play several key roles in universities, teaching, research, community service and administrative duties (Griffiths, 2017). Such characteristics make managing a university challenging; thus, many universities are heavily reliant on MIS for its success (El-Ebiary et al., 2018).

Despite the fact that MIS is used widely in universities' daily operations, there is limited empirical evidence of the actual impact of MIS on the effectiveness and efficiency of employees in universities. Therefore, this research will aim to evaluate and understand the impact of MIS on employees in universities. The objective of this research is to investigate how MIS impacts the daily operations of an academic university. The study will build on Delone and McLean IS success model to better understand how MIS impact Universities (DeLone and McLean, 2003). Furthermore, the study will examine the success of MIS based on employees' perceptions and will examine it from a longer-term post-implementation perspective (5 years). In doing so, the

study will be able to examine the longer-term impact of MIS on universities.

Furthermore, at long term-post-implementation, MIS user direct interaction and actual experience with the system (Saeed et al., 2010) provide an opportunity to study the actual impact of MIS on universities. The study will aim to answer the research question: how do users of MIS evaluate its impact on the effectiveness and efficiency of universities? The study will have both practical and theoretical contributions: first, the study will help in improving our understanding of the impact of MIS on universities. Second, the study will offer some suggestions on how universities can further utilize MIS. Third, the study will offer recommendations for how universities could use current programs and technologies to improve MIS and help universities achieve their objectives. The study will contribute to theory-building by examining and extending the DeLone and McLean's IS success model.

The remainder of this paper is structured as follows. The next section will review literature and theories that examine the impact of MIS on organizations. The methodology of the study is described in the third section. The fourth section presents the findings of the study. The fifth section is the discussion and implications of the study. The paper concludes with a conclusion and limitations section.

2 Literature review

MIS can improve the communications between employees in an organization (Chiang et al., 2018), which makes it possible for upper management to conduct the daily operations in the organizations (Owoc and Marciniak, 2013). A number of studies have shown that MIS can lead to significant improvement and reduction of bottlenecks in the management process (Munirat et al., 2014). Furthermore, studies have shown that MIS could provide the necessary data for effective decision making by upper management (Wanyoike and Nzuki, 2022). As this study examined the impact of MIS on the university from an employee perspective, it is first necessary to review how IS literature understands the word impact of MIS. Several IS scholars have explained that impact could be explained as an improvement in the quality of service provided, outcome, or financial improvement (Abu-Shanab and Saleh, 2014), (Tabassum et al., 2019). There are a number of IS research theories that examine the impact of MIS in organizations (Guillemette and Paré, 2012) and individuals (Compeau et al., 1999). For instance, the theory of Critical success factors explain how to measure the success of MIS implementation by focusing on how MIS impacts the areas that make an organization successful (Thi and Swierczek, 2010). In addition, the Fit-Viability theory examines how factors such as task, technology, and organizations can impact fit and viability and impact the performance of an organization (Liang et al., 2007). Similarly, the Task technology fit theory explains how task and technology characteristics influence fit, which in turn impacts performance and utilization of technology (Goodhue and Thompson, 1995). Other theories, such as the Technology Threat Avoidance Theory, examine how IS could impact the work environment in organizations (Liang et al., 2007). Likewise, the Technology dominance theory explored how decision-makers could become reliant on technology or resist it based on task complexity, cognitive fit, and experience (Sutton and Arnold, 1998). When exploring how users' perception impact MIS, researchers have examined how attitudes toward IT, subject norm, perceived control, ease of use, and perceived compatibility could impact IS adoption, usage, and success (Teo, 2009). This research aims to build on and extend Delone and McLean's IS success model. Their model identified factors responsible for information systems and their impact on individuals and organizations (DeLone and McLean, 2003). They propose that System quality, information quality, and service quality are a significant contributor to MIS usage and user satisfaction with information systems (DeLone and McLean, 2003). Moreover, they identified that MIS usage and user satisfaction influence each other, and they both influence individual impact, which in turn influences organizational impact (DeLone and

McLean, 2003). This study will utilize Delone and McLean's IS success model to better understand how MIS impacts the effectiveness, efficiency, and work progress of a university. The study will also aim to extend this model by examining the success of MIS from employee perspectives and the longer-term factors that impact the long-term success of MIS. The following sub-section further discusses the constructs in Delone and McLean's IS success model and how they relate MIS success.

2.1 Relation between System quality and system Use and User Satisfaction

Previous researchers have indicated that technical factors impact user intention to use the system and their satisfaction with the system (Pitt et al., 1995), (Flack, 2016). For instance, the quality of the content and information provided in terms of their usefulness to the users' (Al-Fraihat et al., 2020), (Alksasbeh et al., 2019), ease of understanding (Alshurideh et al., 2019), reliability (Alkhwaja et al., 2022) and the ability of the user to get to the system on time to find the information needed (Jonathan et al., 2022), (Naveed et al., 2021). Furthermore, system quality has been found to have a similar impact as it positively affects users' Intention to use and their satisfaction (Al-Okaily et al., 2021), (Salam and Farooq, 2020). IS researchers have described system quality as ease of use, ease of learning, and user-friendly interface, (Kanaan et al., 2023). In addition, it is indicated that service quality, such as the functionality of the system, reliability, and responsiveness will have a positive impact on users' Intention to use the system and their satisfaction with the system (Al-Okaily et al., 2021), (Alshurideh et al., 2019). Hence it is hypothesized that the information, system and service quality provided by MIS will have a positive effect on users' Intention to use as well as their satisfaction with the system.

H1: the quality of the information provided in MIS positively affects users' Intention to use the system.

H2: the quality of the information provided in MIS positively affects users' satisfaction.

H3: MIS quality positively affects users' Intention to use the system.

H4: MIS quality positively affects users' satisfaction.

H5: the quality of service in MIS positively affects users' Intention to use the system.

H6: the quality of service in MIS positively affects users' satisfaction.

2.2 Relation between Intention to use and net benefits

Users' Intention to use a system has been discussed by many researchers, e.g. (Kalinic and Marinkovic, 2016), (Liu et al., 2019). It refers to the actual use of the system in terms of frequency, duration and utilizing the full capability of the system (Makkizadeh and Afshani, 2019). Delone and McLean's success model have identified users' Intention to use the system as one of the most important factors that affect net benefits (DeLone and McLean, 2003). Hence it is hypothesized that:

H7: users' Intention to use MIS positively affects net benefits.

2.3 User satisfaction and net benefits

Many studies have reported that users' satisfaction increases their morale and productivity e.g., (Tam and Oliveira, 2016). Some researchers consider user satisfaction as a measure of success for IS implementation. Factors such as system usefulness to the employee, and systems increasing the productivity of employees is considered by some researchers as a sign of users' satisfaction (Seta et al., 2018). If users perceive the system to be useful and help them to finish their tasks better and more quickly, then they are more likely to be satisfied with the system, which in turn has a positive impact on their performance and the overall performance of organizations. Therefore, it is hypothesized that:

H8: users' satisfaction with MIS positively affect net benefits.

2.4 Net benefits

As MIS represents a significant investment for the overall budget of organizations (Joia et al., 2014), it is essential to understand the factors that impact outcome of such investment. It is suggested by researchers that net benefits of system usage mean an increase in the quality of work and an improvement in job performance for individuals (Nygiyeva et al., 2021). In this study, net benefits can be understood as the degree to which MIS has helped employee complete task quickly, improved communications, improved knowledge acquisitions and reduced errors (Gates et al., 2019).



Figure 1. The Delone and McleanIS success model

3 Research Methodology

The research strategy adopted in this study is mixed research methodology. The study was conducted at a university that uses a system called the Administrative Communication System (ACS) which allows management and all employees to send mandate, tasks, and requests and view the progress of their requests. The use of the system is mandatory for all employees, as all mandates, task assignments, and requests are made through the system. The study used mixed research methodology. The questionnaires for this study (abstract 1) were derived from the available literature that discusses The Delone and McleanIS success model e.g., (DeLone and McLean, 2003), (Aldholay et al., 2018), (Seta et al., 2018). (abstract 1). The questionnaires used the Likert scale of 1 to 5 to allow participants to express their perception and opinion of the system, where 1 represented strongly disagree and 5 represented strongly agree. In addition, at the end of the questionnaire, the participants were asked to write their opinion and any additional comments about the system. which will further help the researchers understand participants' perception of MIS and help in the theoretical development of this research.

Following the development of the instrument, the researchers started the data collection process by distributing questionnaires. The questionnaires were distributed online and were analyzed using statistics with multivariate techniques of Structural Equation Modeling (SEM)

4 Data analysis and results

4.1 Model Fit Evaluation

In order to test the research hypothesis, structural equation modelling was performed through AMOS. The researchers investigated the model fitness primarily. This analysis is examined to identify the extent of multi-variables to predict net benefits. The hypothesized framework is evaluated through the model fit output. With a 95% confidence interval, the output revealed CFI >.09, CMNI < 5.0, and RMSEA < .08, demonstrating that this model was good to fit for a hypothetical model in figure 2 (Grace, 2022). Three types of indices have been verified absolute fit indices (CFI = 1.00, NFI = 1.00, TLI = 1.04, Chi-square = .102, p = .950), parsimony indices (CMIN/DF = .051), and increment fit indices (RMSEA = .00). The indices in this study provide an indication that observed data, latent and constructs variables, matrix, and hypothetical model data are fitted very well (Ockey and Choi, 2015).

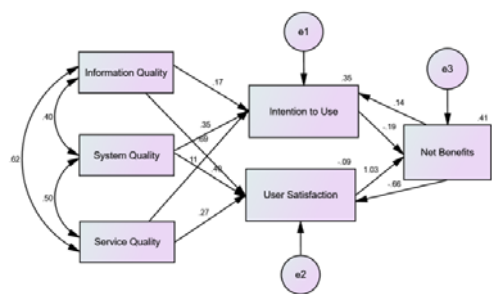


Figure 2. Structural Equation Modelling to test the Study Hypotheses

Figure 2 indicates the effect of information quality, system quality, and service quality on net benefits through Intention to use and user satisfaction. Service quality is significantly covariate with system quality ($r = .50$) and information quality ($.62$). The regression weights revealed that information quality ($\beta = .169, p = .087$, service quality ($\beta = .111, p = .248$, and net benefits ($\beta = .138, p = .192$) insignificantly affected the Intention to use ($p > .05$). While user satisfaction is found as the greater variable that affects net benefits ($\beta = 1.027, CR, 8.473, p = .001$). As the structural equation modelling analysis demonstrated that there is a huge effect of user satisfaction on net benefits. It is stated that user satisfaction explained 102.7% of the variance in net benefits. On the other hand, information quality, system quality, and service quality contributed with the variance of 68.9%, 40.5% and 26.95 respectively. On contrary, the Intention to use reversible affects net benefits ($\beta = -.189, CR, 18.98, p = .058$).

Table 1. Structure Equation Results

Effects of	Direct	Indirect	Total
Information Quality → Intention to use	.169	.055	
Information Quality → User Satisfaction	.689	-.262	
Information Quality → Net Benefits		.396	.396
System Quality → Intention to use	.111	.021	
System Quality → User Satisfaction	.269	-.099	
System Quality → Net Benefits		.150	.150
Service Quality → Intention to use	.347	.028	
Service Quality → User Satisfaction	.405	-.135	
Service Quality → Net Benefits		.205	.205
Intention to use → Net Benefits	-.189	.078	-.111
User Satisfaction → Net Benefits	1.027	-.424	.603
Net Benefits → Intention to use	.138	-.057	.081
Net Benefits → User Satisfaction	-.660	.273	-.387

Table 1 demonstrates the results to test all the research hypotheses. Hypothesis 1 theorized that information provided in MIS positively affects users' Intention to use the system. H1 is rejected as the result revealed an insignificant direct and indirect effect of information quality on users' Intention to use the system. H2 is confirmed as there is a significant positive effect of the quality of the information provided in MIS on user satisfaction ($p = .000$). Hypotheses 3 and 4, MIS quality positively affects users' intention and user satisfaction to use the

system users' are accepted based on p values $< .001$. It is evident that the hypothesis that state quality of service in MIS positively affects users' Intention to use the system is found insignificant ($p = .248$), including weak and negative effects. On the other hand, the effect of the quality of service in MIS on user satisfaction is positively significant ($p = .038$). Hypothesis 7 that theorized user intention to use MIS positively affects net benefits is found significant but negative. On the basis of negative beta estimates and effects hypothesis 7 is rejected. The structural equation modelling results revealed that user satisfaction with MIS positively affects the net benefits with huge and significant effects values. The hypothetical situation regarding the effect of net benefits on the Intention to use the system is rejected based on negative and insignificant results. Further, net benefits can negatively but significantly affect user satisfaction ($p = 0.019$). Conclusively, it can be stated that user satisfaction is the strong predictor of net benefits in comparison to other variables direct effect of 1.027 and total effect of .603. Table 2 provide a summary of the hypotheses testing results.

Table 2: Summary of Hypotheses Testing

No	Hypotheses Description	p	effect	Decision
H1	Information Quality → Intention to use	.087	Positive	Rejected
H2	Information Quality → User Satisfaction	.000	Positive	Accepted
H3	System Quality → Intention to use	.000	Positive	Accepted
H4	System Quality → User Satisfaction	.000	Positive	Accepted
H5	Service Quality → Intention to use	.248	Positive	Rejected
H6	Service Quality → User Satisfaction	.038	Positive	Accepted
H7	Intention to use → Net Benefits	.058	Negative	Rejected
H8	User Satisfaction → Net Benefits	.000	Positive	Accepted
H9	Net Benefits → Intention to use	.192	Positive	Rejected
H10	Net Benefits → User Satisfaction	.019	Negative	Rejected

4.2 Analysis of the open ending questions

Analysis of the open ending question was conducted using thematic analysis using NVivo software. Thematic analysis is often used by researchers to classify and categorize common keywords in order to find relevant themes in the text (Vaismoradi et al., 2016). During this process, the researchers looked for the recurrence of themes within respondents' answers (Vaismoradi et al., 2016). The researchers followed a representational way of coding where text fragments are assigned a theme (Vaismoradi et al., 2016). Participants' answers to these questions were read line by line and coded to themes. This mode of analysis allows for the researcher's interpretations of the text and helps in capturing manifest content as well as the latent meaning of a text (Bradley et al., 2007). The following sub-section present the findings of the open-ended questions.

4.3 Findings of open-ended questions

The results of the thematic analysis of the open-ended question show that participants are generally happy with the impact MIS had on their productivity and efficiency. The analysis highlighted two main themes, system quality and the need for improvement. The following subsection discusses the findings of the thematic analysis of the open-ended question.

4.3.1 System quality

A number of respondents to the study discussed their frustration regarding the quality of the system. Common sub-themes are the issues related to the reliability and speed of the system. For

instance, one participant explained his frustration with the speed of the system "the system is too slow, sometimes I open the system, then I do something else and wait for the system to open, once the system opens, I forget why I opened it in the first place."

Themes related to system reliability also appeared in the data. Users discussed that the system could be unreliable at times; one said, "it seems like the system always fails at crucial moments." This indicates that some users perceive the system to be unreliable and the system has poor quality.

4.3.2 Continuous improvement

A common theme related to the need for system improvement occurred in this study. Generally, the participant of the study has a positive view regarding the system. However, the participants of the study believed that the system could be improved upon. For instance, participants discussed the need for a better search function in the system. one participant said, "sometimes it is difficult to find information; I think that this can be easily fixed". Another participant discussed the need for an instant chat function to discuss tasks with co-workers. She remarked, "most times I find people using WhatsApp or emails to contact me and ask for clarification. So, I have to check the system, WhatsApp and my emails to get things done. It should all be in one system". Despite such comments regarding the system, it appears that users perceive the system to be useful and generally are happy with it. Though, there are features and functions that users require to help them be more productive and efficient.

5 Discussion

The purpose of this study was to investigate the impact of MIS on the daily operations of an academic university from an employee perspective.

To this end, a mixed research study was conducted to understand the impact of MIS on the educational process from the employee perspective. The study builds on Delone and McLean IS success model to better understand how MIS impacts Universities. Furthermore, the study examined the success of MIS based on users' perceptions and examined it from a longer-term post-implementation perspective (5 years). The study confirmed some aspects of the model and explained that system quality, information quality, and service quality impact users' satisfaction. Further, the study explained that users' satisfaction impact net benefits. The findings of this study supported 5 of the 10 hypotheses it proposed. Moreover, the findings of this study suggest that The Delone and McleanIS success model can be further extended to examine the factors that impact users' continuous use of MIS thus improving and extending the impact of MIS on universities (Figure 3). The study suggests that Delone and McleanIS success model should be viewed as a cycle where organizations need to regularly improve MIS in order to continue the success of MIS and its positive impact on organizations. Further, the study indicated that continuous system improvement is an important factor for the long-term success of MIS.

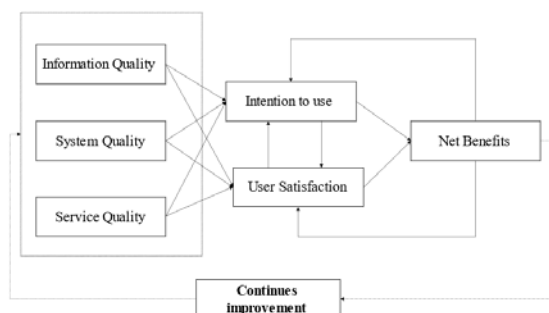


Figure 3. Extension of The Delone and Mclean IS success model: The continuous success model.

The findings of the study suggest that information, system, and service quality have positive effects on users' satisfaction which

is consistent with previous researchers (DeLone and McLean, 2003), (Shahzad et al., 2021) while it found that system quality has positive effects on users' actual use. This indicates that the higher system qualities in terms of ease of use, speed, and reliability the more likely that users' will use the system and the higher user satisfaction. For information and service quality, the results of the study do not show a significant relationship with actual use. This could be because the use of the system is mandatory in the university; hence, employees believed that they had to use the system even though they did not perceive information and service quality to be good. This is in line with some researchers who have determined that factors affecting satisfaction may not affect usage in mandatory settings (Çelik and Ayaz, 2022)

Furthermore, the study identified a significant relationship between users' satisfaction and net benefits. This suggests that the higher the users' satisfaction with the system, the higher the net benefits will be. These findings are in line with the previous researchers, which indicated that users' satisfaction has a positive impact on system net benefits to the organization, such as an increase in employee productivity and efficiency e.g. (Karoba et al., 2020), (Lee and Jeon, 2020). With regard to system actual usage, the results do not show that it significantly affects net benefits. This again may be explained by the fact that the usage of the system was mandatory. Previous researchers have suggested that mandatory use of the system may not impact net benefits as employees have little choice in using the system. Therefore, in mandatory settings, the employee may use the system but experience low morale, which in turn could impact net benefits (Hwang et al., 2016)

In addition, the findings of the open ended questions of the study propose that continued improvement could have a positive effect on the system, information, and service quality as well as a positive effect on user satisfaction and net benefits. While most users believed that the system had a positive impact on the organization by improving the productivity and efficiency of employees. Some users' believe that the system needs improvement to further increase the positive impact it is having on the university. Such as improvements in the speed, and reliability of the system as well as improvement in the functions and features of the system, is likely to increase the productivity and efficiency of employees and will improve university outcomes. Therefore, it is recommended that management should focus on regularly checking and improving the system quality to improve users' satisfaction and net benefits.

6 Contributions

The study will have both practical and theoretical contributions: first, the study contribute to theory by improving our understanding of the impact of MIS on employees on universities. Second, the study contribute to theory-building by examining and extending the Delone and McLean's IS success model and introducing the concept of continuous improvement to achieve continued success to the Delone and McLean's IS success model. In terms of practical contributions, the study offers some suggestions on how universities can further utilize MIS. As well as offer recommendations for how universities could use current programs and technologies to improve MIS and help universities achieve their objectives.

7 Implications

The study confirms Delone and McleanIS success model and further extends it by highlighting the importance of continuous updates of MIS on net benefit. The findings of the study indicated that universities employees recognized some key benefits of MIS on the organization, such as the openness, accessibility, and quick spread of information across the various department in universities. In addition, it helped improve management control of the daily operation and provided better data for decision-makers which reflected positively on university performance.

Subsequently, the proposed extinction of The Delone and McleanIS success model (figure 3), implies that universities can further benefit from exiting MIS by continuous improvement on

MIS as well as user involvement and engagement to extend the benefits of MIS. It is recommended that the university technically upgrade the system to improve its speed, usability, and reliability of the system. Moreover, other features could also be implemented, such as instant chat to improve communication between employees and to help employees understand unclear orders from management. Moreover, the system would benefit from including a better search and retrieval function. Likewise, it would help employees finish that task on time if the system could be directly linked to their personal calendars such as google calendar or outlook calendar.

8 Conclusion

This research provided an examination of the impact of MIS in universities from an employee perspective. The study explained that information, system, and service quality have positive effects on users' satisfaction and users' satisfaction has a positive effect on net benefits.

The study provided great insight on the factors that impact system net benefits on organizations. However, the findings have some limitations and should be taken with some caution. First, the sample was selected from employees of a small public university. Hence the findings of the study should not be generalized to reflect the impact of systems on all universities. Future researchers can address these limitations by widening the sample size and examining the impact of MIS on multiple universities. Furthermore, the study examined the impact of a specific type of system. Thus, the findings of the study should not be generalized to reflect the impact of all types of systems on all universities. Future research should examine the impact of different types of systems on the performance of universities such as e-learning systems. Finally, the study examined the impact of MIS on universities from employee's perspective. Future researchers can further extend our understanding of the impact of MIS on universities by examining the impact of MIS on universities from managers' perspectives as well as examining the impact of MIS on universities' performance by comparing the productivity of employees before and after MIS implementation.

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CREATION OF 3D MODELS OF REAL OBJECTS USING CLOSE-RANGE PHOTOGRAMMETRY IN EDUCATION

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Abstract: Nowadays, in a time of rapid development of many scientific disciplines, solutions are emerging that require knowledge from several fields. Promoting cross-curricular relationships is also becoming relevant. Its importance is also clear in higher education. It creates and deepens students' competences and enables them to take a broader view of related or underlying fields. 3D models are a very suitable tool to support cross-curricular relationships, where their importance is not only in the creation of the 3D model itself, but the results obtained in this way are also fully applicable in the educational field as a visualization tool. This is an interesting activity for students, but also the creation of models hides a number of possible complications that can complicate their creation and if the model fails, it can discourage the student. Therefore, it is important to be able to react correctly and choose the appropriate course of action. It is not necessary to obtain new photographs, but manual intervention in the creation of the 3D model is sufficient. The method of creating 3D models and their importance in the educational sphere have already been presented in several of our publications, for example [1-6]. However, practical implementations show that although students are very positive about this activity, they often encounter problems in post-processing. It is on post-processing procedures that we will focus in our paper. Using concrete examples, we will show the three basic editing methods we have proposed (adding manual tie-points; editing a meshed model by removing point clouds and properly removing the visible part of the model), which once mastered, students will be able to solve most problems in the creation of 3D models without deeper technical knowledge.

Keywords: Education, 3D models, Photogrammetry, Tie-points, Point-clouds, 3D model modification.

1 Introduction

Our previous work shows that 3D models are a very good tool for supporting intersubject relationships. Nowadays, thanks to modern technological solutions, they can be easily implemented in the teaching process, and both software and hardware tools for creating 3D models are available. Today, students already have a variety of tablets and mobile phones, the cameras of which are sufficient to take photos and create 3D models. [1-6] Realistic 3D models can be obtained in several ways. Currently, non-contact methods are divided into LiDar-type methods and photogrammetric methods. Of the photogrammetric methods, in the next text we will focus on close range photogrammetry. Photogrammetry obtains information about physical objects and environments from photographs. Basically, it's about creating 3D models from 2D photos or images. This method is often used in architecture, engineering, manufacturing, archeology and in the field of cultural heritage protection. Close range photogrammetry focuses on objects that are close and does not require the use of an aerial photogrammetry or UAV, which is used for example in the protection of cultural heritage. [7-9]

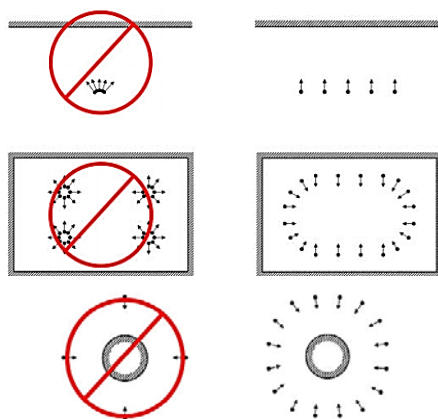


Figure 1 – incorrect and correct methods of obtaining photos according to the type of object. Above: facade, in the middle: interior, below: isolated object [10]

The basis for creating 3D models are photos of the scanned object. The correct method of photographing an object according to its shape is shown in figure number 1. When processing photographs, the so-called key points. They are well identifiable and recognizable points on several images. They are the basis for determining the position or movement of the camera and the arrangement of images relative to each other. Subsequently, the Tie points are determined, which are crucial for determining the mutual relations and orientation of the images, which enables accurate connection into one coherent 3D model. Those points do not yet carry any spatial information. Point Cloud is a set of points in 3D space, with spatial information - that is, they carry data about the position in the coordinate system. Each point in the cloud represents part of the surface of the object and together they form a detailed 3D structure of the model. Those points do not have to be present only on the scanned object, but also in its surroundings. This is clearly visible in picture number 2. The 3D model itself is created from the point cloud. This process transforms a set of points from a point cloud into a continuous surface grid (mesh) that represents the shape and surface of the object in three-dimensional form. Meshing connects points from a point cloud. In practice, the most widespread is the triangle mesh. [3-5,11-13]

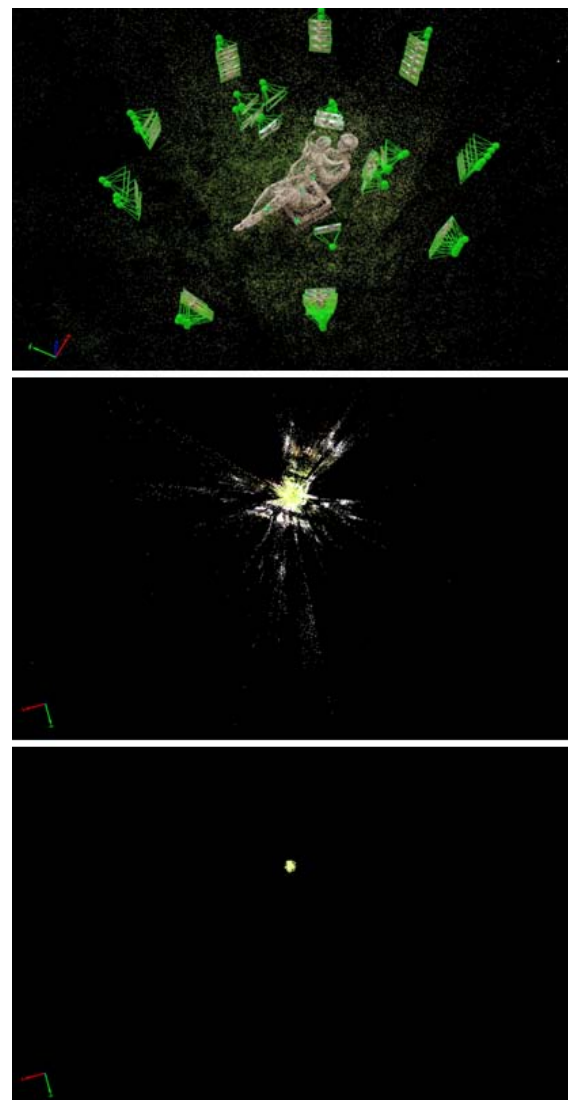


Figure 2 – Above: location of the cameras when obtaining photos, in the middle: Tie points of the object, below: Point cloud of the object while maintaining all the size parameters used in the image in the middle

2 Material and methods

We used the Pix4Dmapper Pro photogrammetry software to process the photos. It is a product of the Pix4D suite of products. Pix4D software uses imagery captured with drones, mobile devices, or planes to recreate scenes in 3D. It is characterized by high accuracy, automatic processing, supports the processing of RGB images, images from thermal cameras or multispectral images and, in addition to 3D models, it can also create digital maps. [14] All the models discussed in this article were created with the camera of the OPPO Reno 5Z mobile phone, with the help of a computer with the following parameters:

- Hardware: CPU: Intel(R) Xeon(R) CPU E5-1650 v3 @ 3.50GHz; RAM: 32GB; GPU: NVIDIA Quadro K4200 (Driver: 9.18.13.4121).
- Software: Pix4Dmapper Pro 2.0.104 – 64 bit; Windows 7 Professional, 64-bit.

Errors often occur when creating 3D models. It often happens that the created model is not a reliable image of reality, but contains several errors and inaccuracies. Some of them do not significantly affect the quality of the model (local texture color error, slight deformation of the surface), but others do (missing part of the surface, significant deformation, ...). These need to be removed and repaired. Especially in education, failure can easily cause demotivation. Therefore, it is necessary to control the subsequent processing and not to rely on success in the creation of a 3D model for the first time. From the post-processing processes, we will mention the use of manual Tie points, the correction of point clouds by removing them, and we will also focus on cropping.

3 Results

In Figure 2 we have shown the locations of the cameras, tie points and point clouds of the mother and child sculpture. We have chosen this statue also because it is a typical representative of the architecture of the former regime. It had its own character, but that is being lost by the automatic rejection of everything connected with the former regime. In Figure 3 we show the Point cloud of the sculpture (compared to Figure 2 it is more enlarged) and the resulting 3D model itself from the same point of view and the same position.

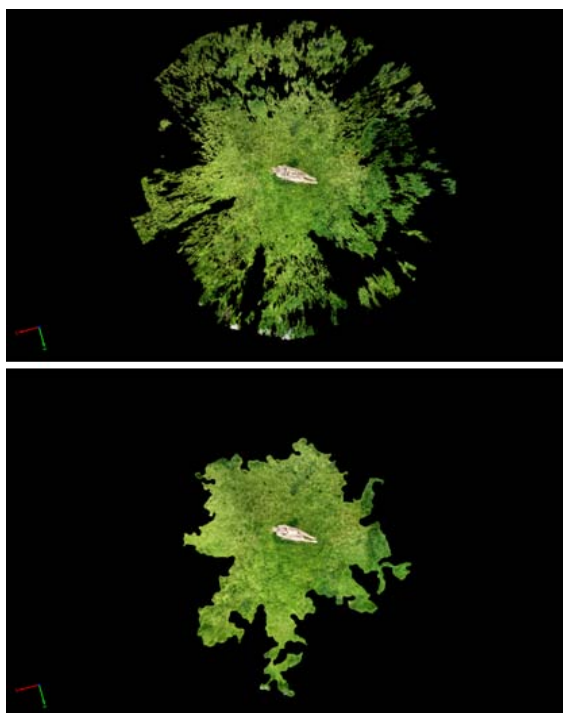


Figure 3 – Point cloud and 3D model of the statue

The resulting 3D model was not created the first time, but needed to be modified. In the automatic processing process, the software excluded almost half of the photos because it could not find enough points to pair them. Probably there was not enough overlap between some adjacent photographs. The 3D model created was therefore only partial. This condition is illustrated in Figure 4.



Figure 4 – Location of cameras and Tie points earned from them

We will use manual Tie Points to solve. These are selected so that they are visible in as many images as possible and so that they represent a distinctive point on the object. We show these in Figure 5. We chose the top of the leg crack, the child's toe, the two opposite edges of the pedestal, and the tip of the child's hair. Our aim was to find points that are evenly spaced on the object and are well identifiable. We manually add points by selecting one point and clicking on the "New Tie Point" button in the "Images" section of the window - the red arrow. We then start marking this point on other photos. After marking at least two photos, we can use the "Automatic making" button. If the software recognizes the point in the photos, it will mark it with a green marker. We use the yellow marker to mark the manual placement of manual Tie Points. Although it's not clearly visible in Figure 5, but by using the slider we can zoom in on the photos and thus pinpoint a particular point more accurately. Ideally, the centers of the green marks and the yellow marks are identical. However, this is not always possible to maintain and deviations can occur. In such cases, we try to use as many photographs as possible and pinpoint a specific point on them - down to a specific pixel if we can. The software starts to recalculate these positions and the centers of the marks start to converge. Here we have to point out a very common mistake. Users add points to individual photos but the accuracy does not improve. The reason for this is incorrect place marking. It sounds like a mistake of inattention, but it very often occurs especially in cases where the photos are quite homogeneous in color and many parts are easily confused (parallel grooves, regular inaccuracies, ...). When you have finished adding manual Tie points, start the reprocessing from the "Local processing" menu. If there is no change or only a partial change, we have to add a number of manual Tie Points. In our case, this number of points was sufficient and we included all the images as shown in Figure 2 for the camera placement. Of course, by exaggerating the manual addition of Tie points we can also damage the whole 3D model. When adding images cannot be achieved with 10 manual Tie points, it is a good idea to consider re-acquiring images of the object.

Thus, by manually adding Tie Points we can affect the dimension of the 3D model. This can be used, for example, in the case where we only have a small number of photos and can only create a partial 3D model. Such cases are, for example, when the object to be imaged is at height or in a dangerous environment and we can only obtain photos from one position with a range practically equal to the span of our hands. Even in such a case, we can create partial 3D models from the photographs, but it may happen that the desired part will not be part of the created 3D model. For example, bird nests, wood-boring fungus, etc. By manually adding Tie points we can achieve filling in the missing part. For more details, see [6].

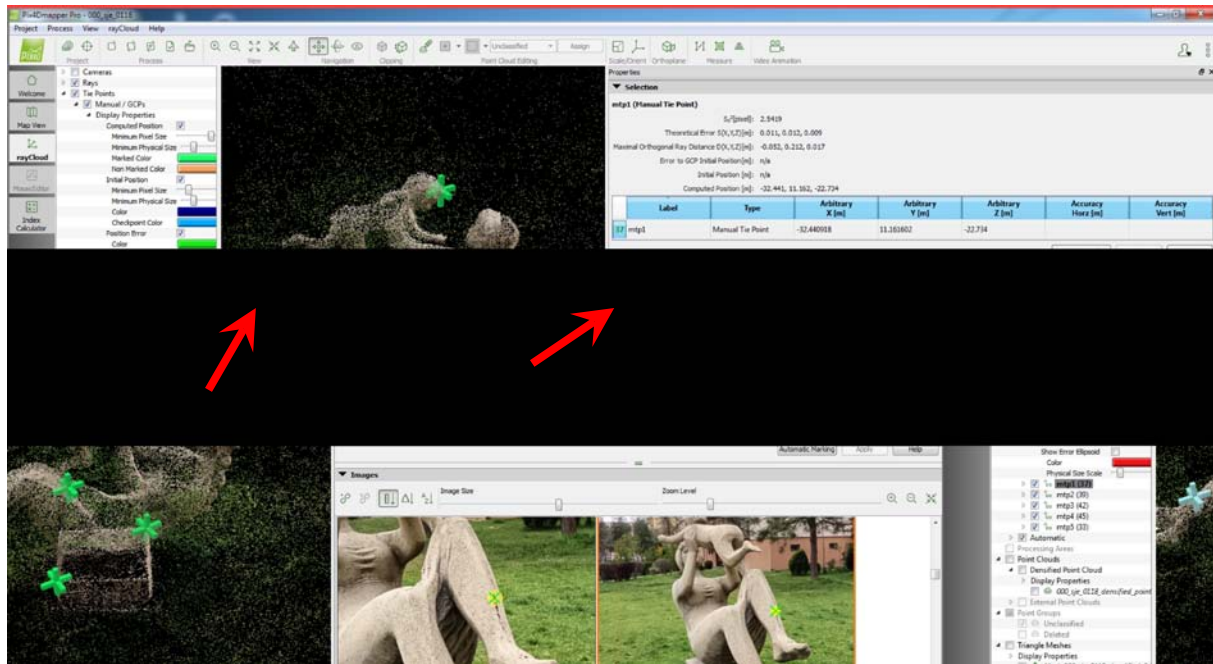


Figure 5 – Adding manual Tie points in Pix4Dmapper Pro

The aforementioned Tie point was marked on 37 photographs. The baby's thumb in 32 photos, the opposite edges of the base in photos 42 and 39, and the tip of the baby's hair in 45 photos out of a total of 80 photos.

It often happens that the created 3D model contains imperfections caused by incorrect determination of a point from the point cloud. In this case, we have to make the adjustments on the mentioned cloud of points. An example of such an error can be seen in figure 6 above. Usually the points outside the object are well discernible. We will remove all points that do not belong to the 3D model. Deleted points are indicated in red.



Figure 6 – Editing Poit cloud

These errors were not yet visible when viewed from image number 3. The resulting 3D model after all previous adjustments is shown in image number 7. After removing the faulty points of the cloud, it is enough to run "Generate 3D textured mesh" from the "Process" menu.



Figure 7 – Final 3D model

One of the statistical parameters we monitor for 3D models (because they can give us an initial assumption about the quality of the 3D model) is 3D Points from 2D Keypoint Matches. The results can be presented graphically as well as in a table. Each 3D point is generated from key points that have been observed in at least two images. The first column of the table shows the number of 3D points that were observed in N images - the second column. The higher the number of images in which a 3D point is visible, the higher its accuracy. For our model, the table is as follows:

Table 1 – Number of 3D Points Observed

In 2 Images	408313	In 13 Images	151
In 3 Images	103706	In 14 Images	107
In 4 Images	38048	In 15 Images	79
In 5 Images	18545	In 16 Images	58
In 6 Images	10892	In 17 Images	57
In 7 Images	2906	In 18 Images	21
In 8 Images	1368	In 19 Images	7
In 9 Images	884	In 20 Images	10
In 10 Images	620	In 21 Images	2
In 11 Images	433	In 22 Images	4
In 12 Images	233	In 24 Images	1

In table no. 2 we present the 2D Keypoints Table. The 2D Keypoints Table displays some statistics of the keypoints and the matches of the project. Keypoints are points of interest (high contrast, interesting texture) on the images that can be easily recognized. Parameters number of matched 2D keypoints per image is a matched point is a characteristic point that has initially been detected on at least two images (a 2D keypoint on these images) and has been identified to be the same characteristic point.

Table 2 – 2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	41421	19386
Min	16024	1789
Max	60592	32400
Mean	41602	18730

Median of keypoints per image is 41421 at 11.41% relative difference between initial and optimized internal camera parameters. All photos were without location and GPS data. Number of Generated Tiles was 1 and Number of 3D Densified Points was 3270659. Camera model: OPPOreno5Z_4.7_4000x2256 (RGB). The total time required to create a 3D model consists of three times:

Time for Initial Processing : 6m:18s
 Time for Point Cloud Densification : 8m:28s
 Time for 3D Textured Mesh Generation : 2m:42s

For one Tie point which we mark on about 30 photos we can count on the time needed for processing 4-10 minutes. We also have to take into account the fatigue of the students and this time can be greater with a large number of Tie Points. In the following figure we present Number of Automatic Tie Points. The number of Automatic Tie Points (ATPs) per pixel averaged over all images of the camera model is color coded between black and white. White indicates that, in average, more than 16 ATPs are extracted at this pixel location. Black indicates that, in average, 0 ATP has been extracted at this pixel location. Average direction and magnitude of the reprojection error for each pixel indicated by the blue lines. Vectors are scaled for better visualization. [14]



Figure 8 – Number of Automatic Tie Points for our object

In general, it can be argued that as long as this characteristic for any object is white at least in the object region, it indicates that a 3D model can be created and will be of sufficient quality.

For the sake of completeness, we can mention the following three characteristics:

- Number of 2D Keypoint Observations for Bundle Block Adjustment: 1498422
- Number of 3D Points for Bundle Block Adjustment: 586445
- Mean Reprojection Error [pixels]: 0.207682

We can also use manual Tie points to solve the problems shown in Figure 9. In this case, we can see that the software has created

Automatic Tie points for different sizes of the same monument. The reason for this can be the acquisition of photographs from significantly different distances, different values of F-stop, blur or focal length, the use of different cameras with different parameters, etc. The green markers show manual Tie points.

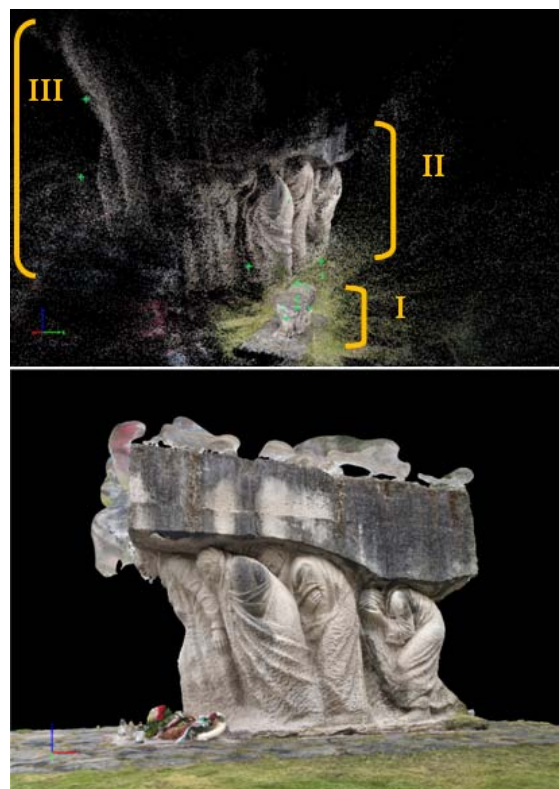


Figure 9 – Tie points of non-uniform size of the same object and the 3D model after adding manual Tie points below

In the creation of 3D models, it sometimes happens that although the camera positions are correct, neither Tie Points nor Point Cloud show significant flaws and the resulting 3D model is created, but without the desired object. This happens especially when the background occupies a larger area in the photographs and not the object to be captured. The case is illustrated in Figure 10. At the top, you can clearly see that the object being imaged is part of the 3D environment formed by the point cloud points, but is missing from the scene after the 3D model has been created - the image in the middle. Note that the sensed object is isolated, so it is not part of the background. The software tries to create only one model and therefore creates a background model. The solution in this case is that we remove all points of the point cloud except the points of the scanned object. When the model surface is recreated, the background will no longer be present but only the sensed object. We can see this in figure number 10 below.

4 Discussion

In teaching it is important that the 3D model is successful and that students are motivated by their work and not discouraged from further activity. Therefore, it is good if their first models succeed even on the first attempt. The basis of creating 3D models using the photogrammetric method is the acquisition of image data. These can be obtained in two ways - photographs or video. When acquiring photos or video, we have to follow certain rules so that the photogrammetric software can correctly create the 3D model. Therefore, based on our experience, in addition to the above mentioned, we also recommend observing the following points, which have a significant impact on the creation of a 3D model without the need for post-processing:

- Even lighting - lighting should be even where possible, with no strong shadows, and we also avoid shooting

against the sunlight. We must also be careful of moving shadows, such as the movement of the sun during the day or the change of lighting source in laboratory conditions. This means that in nature, we only take photographs once during the day and do not add to the photographs. If necessary, we repeat the whole acquisition once more.

- Sufficient overlap - the currently captured photo should be with the previous photo at 60 - 80% in overlap. Our experience tells us that this overlap is good to maintain in both horizontal and vertical directions. The better the overlap the better the result. But there is a certain limit, after crossing which the 3D model will not gain in accuracy or quality, but on the contrary, it may cause damage. For an object with dimensions of approximately 30-30-30 cm, no more than 200 photographs are needed.
- Resolution and photo quality - the higher the resolution, the more detail the photos capture. The resulting 3D model will be all the more detailed. However, some software has some limitations on the maximum resolution which we have to accept.
- Motion minimization - objects that move between shots can cause reconstruction problems. Therefore, avoid such shots as they can cause inaccuracies in the 3D model. Such as moving cars in photographs, movement of people, etc.
- Angle of view - we shoot the subject from different angles, approximately equidistant, and try to cover the entire subject so that each part of the subject is clearly visible in multiple frames.
- Glossy surfaces - Glossy or reflective surfaces can interfere with the photogrammetry process as they can distort texture information but can also affect the formation of Tie-points and thus have a direct effect on the quality of the resulting model. Gloss is also caused by painted or dyed objects.
- Object texture - to properly create a 3D model, it is important that the subject is not only well lit, but also has a good texture. Such objects include natural non-glossy stone, natural wood, leather, paper, etc.
- Size of the subject - when photographing, we must also try to make sure that the subject is dominant in the photographs and occupies a large enough space in the photo. Otherwise the software will create a 3D model of the background and not the subject.
- Background in lab conditions - when possible, we use a simple and consistent background so that the software can more easily identify and model the main object.
- Manual settings - we use manual camera settings when taking photos to ensure that each photo is sharp enough and of good quality even if the distance from the camera changes. Blurry shots are not usable and are often discarded from processing by the software.
- Post-processing - some literature sources also mention the possibility of editing photos before the actual creation of the 3D model. However, we do not recommend such editing but rather discard inappropriate photos. By processing the colors in the photos, the edges may also change which may adversely affect the quality of the 3D model.

Probably the most common issue when implementing it in the classroom will be the time it takes to create a 3D model. From our previous studies [1-6], we venture to say that there is little correlation between the number of photos and the processing time. However, there is a correlation between the number of points processed and the time to create a 3D model. This is logical because we do not know in advance how many key points and tie points the software will find. The processing time is difficult to predict and hence the number of teaching hours is difficult to determine. We propose to schedule the creation of the 3D model for 3 lessons with 45 minutes of each lesson. We also have to account for post-processing. One lesson should be sufficient for post-processing, but this is very subjective. Some pupils are smarter, others are not. Some have the opportunity to work on their projects during their free periods, others only in computer science classes. The post-processing time depends on the number of photos that need to be processed. In some cases,

less precision is sufficient - in that case we can move faster, while other times we try to process as much as possible from the details. The precision of the post-processing therefore also has an impact on the overall processing time.

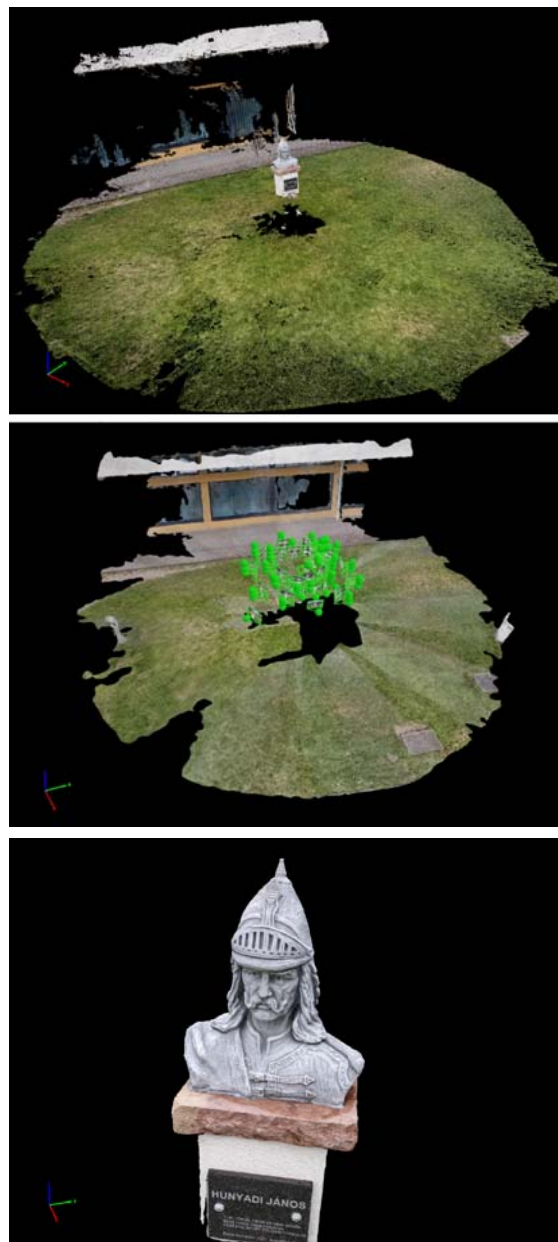


Figure 10 – Above: cloud of points also with object scanning, in the middle: created 3D model with the position of the cameras during photo acquisition, below: desired part of the 3D model

The creation of 3D models has indeed become available these days, and we are increasingly seeing that it is also being implemented in the educational field. Until now, students did not have such a rich technological background that the creation of 3D models could become available on a daily basis. We must also mention that this is an interesting and motivating activity for students. It deepens interdisciplinary relationships with many subjects such as mathematics, physics, but also geography, history and the like. Indeed, it belongs to the few practices that have such a broad interdisciplinary scope. For the teacher, these procedures can be interesting, especially from the point of view of repeatability. Thus, proven sets of photos can be repeatedly used in several years. The hardware requirements are also no longer enormously high. Of course, more powerful computers will significantly reduce the processing time, but even not the most powerful computers can also handle these tasks. If we care about the processing time, the negative can be the price of the

hardware but also of the software. Of the many, we can mention a few of the most widespread: Agisoft Metashape (formerly PhotoScan) - one of the most popular commercial software. It is paid, but according to several sources it is currently the best. Pix4Dmapper – commercial software often used in UAV technology and near photogrammetry. MicMac - Free and open-source photogrammetry tool. Regard3D is similar. Nowadays, there are indeed many software designed for different platforms. From the point of view of use, we can boldly claim that a 3D model created from a real object is much better than a 3D model of ideal clothes. Real 3D models preserve all the parameters of the object, both color and size, and are very valuable in the educational process. In addition, the 3D model is not subject to decay, decay or the ravages of time. It can be viewed at any time - even from the comfort of your home, it is not tied to seasonality, provides better visualization than a photograph and is also suitable for external study.

5 Conclusion

We have tried to choose a typical example and typical problems that can be encountered in common practice when creating 3D models in computer science lessons. We pointed out the most common problems in creating 3D models that we have encountered and caused problems during our practice. We also tried to point out the basic statistical characteristics of 3D models and methods of obtaining photographs, in order to limit the negative effects on the creation of 3D models. We firmly believe that this information will be helpful to many who encounter similar problems, whether in teaching or non-teaching fields.

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JY	FIREARMS, AMMUNITION, EXPLOSIVES, COMBAT VEHICLES

CONDUCTING AN EXAMINATION OF THE TRAJECTORY AND WORKSPACE OF THE MANIPULATOR WITHIN THE MATLAB ENVIRONMENT

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Abstract: The paper delves into the possibilities of computer modeling for manipulator systems within the Matlab program. The analysis is directed towards a two-link manipulator model. Within the framework of kinematic analysis, the paper confronts the solution to the inverse kinematics problem and subsequently navigates through the solution to the direct kinematics problem. The trajectory is modeled by a fifth-degree polynomial during the motion from a known initial position to the specified final position within defined working regions of the manipulator. The work encompasses graphical representation of the results. The manipulator's workspace is also delineated, considering angular constraints on both arms and illustrating the trajectories during operational movement.

Keywords: manipulator, workspace, computer modeling, kinematic analysis

1 Introduction

The use of computer simulations is advancing alongside rapidly developing software and hardware designed for user applications in various engineering fields. Software simulations allow assessing the system's behavior during motion in work-related activities. Created animations provide a real-time overview of movement, allowing for retrospective adjustments to the designed model and retesting the model's functionality through a new simulation. Solution outputs in the form of graphs enable real-time monitoring of variables during the simulation. Computer modeling is renowned for its speed of execution and solution flexibility [1-4].

Computer modeling can be categorized based on the methodology of model creation and solution:

- Mathematical modeling, including software like Matlab, Maple, Mathematica
- Multibody modeling, utilizing software such as Matlab, Simulink, Simscape, MSC Adams

Mathematical modeling employs mathematical equations to define the properties of elements in the modeled system, expressing motion through derived equations and kinematic dependencies among model components. Due to the time-intensive nature of deriving motion equations and equations expressing kinematic dependencies, mathematical modeling is predominantly employed in solving simpler models with a lower number of degrees of freedom [5-7].

Multibody modeling differs from mathematical modeling in that it does not describe the motion equations of the modeled system. Various software options allow defining a multibody dynamic system - Multi Body System (MBS) - with a wide range of body shapes. By defining the geometry of bodies with various basic shapes, a solvable model can be created. This approach saves time, as there's no need to formulate motion equations. However, these programs demand robust hardware and the expertise, knowledge, and skills of the designer [7-9].

In the subsequent chapters of the contribution, the utilization of computer simulation in the Matlab program will be demonstrated.

2 The manipulator model

In the field of robotic systems kinematics, we encounter the solution of direct and inverse kinematics tasks. In this section, the solution to the direct and inverse kinematic tasks employs a model of a two-link robotic arm, as found, for instance, in Scara manipulators, an example of which is shown in Fig. 1 a) - b). The inverse kinematics task aims to determine the angular coordinates of actuators given the positional coordinates of the endpoint. In terms of kinematics, the analyzed Scara model is considered relatively simple and can be solved analytically. The solution approach will be based on the scheme of the two-link robotic arm in Fig. 2 a) - c), [1-3].

If we look at the model from the kinematics perspective, it represents an open kinematic chain in terms of structure. The individual links of the kinematic chain are connected by kinematic pairs. In this case, rotational kinematic pairs are employed. The model consists of two arms with lengths $L_1=0.22$ [m] a $L_2=0.19$ [m], anchored to a fixed base. This base could be either a stand, or the arms may be mounted on a mobile chassis, especially if intended for use as a service robot. A manipulator with a fixed base and two arms has 2 degrees of freedom in movement. We will investigate the motion of the two arms of the manipulator in a plane in Fig. 2 b) - c) [1-4].

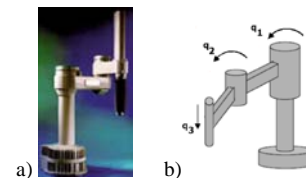


Figure 1. a) Scara manipulator, b) Scara manipulator model [1-3].

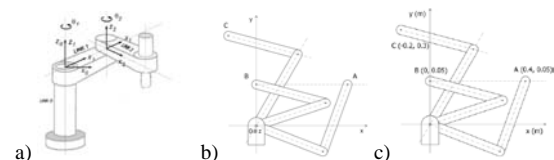


Figure 2. a) Scara manipulator [1-3], b) - c) two link manipulator model.

The objective of the study is to investigate the motion of the arms, specifically focusing on the movement of the endpoint of the second arm. These involve concurrent motions. Matrix methods, commonly encountered in the works of various authors [1-4], are advantageously employed in their resolution. The paper will further address the inverse and direct kinematics tasks. The rotation angle in each kinematic pair is denoted by angles θ_1 , θ_2 as per Fig. 2a). Each element is assigned a coordinate system O_i, x_i, y_i, z_i and each joint is assigned a generalized coordinate q_i , defined along the axis of rotation (Fig. 2a). Generalized coordinates determining the instantaneous position of the body are denoted q_1, q_2 (Fig. 3). It holds true for generalized coordinates that $q_1 = \theta_1, q_2 = \theta_2$. We assume that the actuators are situated in rotational kinematic pairs.

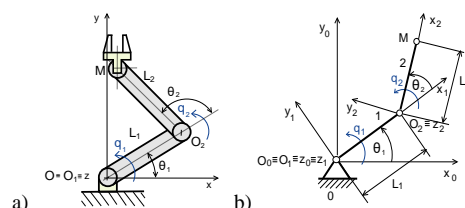


Figure 3. a-b) Model of the manipulator with generalized coordinates $q_1 = \theta_1, q_2 = \theta_2$ in joint.

Before addressing the direct kinematics problem to determine the position of the end effector of the arm, we need to know the rotation angles for the given arm configuration. Therefore, the inverse kinematics problem is initially solved. Considering the desired location of the end point M of the robotic arm, denoted by x_M, y_M , we aim to determine the joint rotation angles that position the endpoint M at the specified location, as shown in Fig. 4. The positions of points are listed in Table 1.

The position of the end effector M is described by the equations:

$$\begin{aligned} x_M &= L_1 \cos \theta_1 + L_2 \cos (\theta_1 + \theta_2) & (1) \\ y_M &= L_1 \sin \theta_1 + L_2 \sin (\theta_1 + \theta_2) & (2) \end{aligned}$$

To determine the angles, we will employ the equations (1) and (2) provided below. Typically, there is more than one solution, as evident in Table 2. The task will be addressed concerning the movement of the end point of the second arm, traversing different positions denoted as A, B, C, with their respective coordinates listed in Table 1.

Table 1. Coordinates x, y of the points A, B, C

	A	B	C
x (m)	0.4	0	-0.2
y (m)	0.05	0.05	0.3

For the given position x_M and y_M (Tab.1), the solution involves determining the values of the two unknown angles, θ_1 a θ_2 , through the resolution of equations (1) and (2). This constitutes the resolution of the inverse kinematics problem. In MATLAB, this is achieved using the following script:

```
x0=0.400 %M0
y0=0.050
xtf=0 %Mtf
ytf=0.050
L1=0.220
L2=0.190
syms theta10 theta20 thetaltf theta2tf
E10 = L1*cos(theta10)+L2*cos(theta10+theta20)-x0;
E20 = L1*sin(theta10)+L2*sin(theta10+theta20)-y0;
[theta10, theta20] = solve(E10,E20);
theta10 = double(theta10*(180/pi))
theta20 = double(theta20*(180/pi))
E1tf = L1*cos(thetaltf)+L2*cos(thetaltf+theta2tf)-xtf;
E2tf = L1*sin(thetaltf)+L2*sin(thetaltf+theta2tf)-ytf;
[thetaltf, theta2tf] = solve(E1tf,E2tf);
thetaltf = double(thetaltf*(180/pi))
theta2tf = double(theta2tf*(180/pi))
```

We calculate the angles of the arms in the initial position of point M₀ x_{M0} and y_{M0} and determine the angles θ_{10} a θ_{20} . Subsequently, we ascertain the angles of the arms in the final position of point M_{tf} x_{Mtf} and y_{Mtf} and identify the angles θ_{1tf} a θ_{2tf} , as presented in Table 2.

The angles' magnitudes during the movement of the endpoint along the trajectory between points A-B and B-C are detailed in Table 2.

Table 2. Sizes of angles between points A-B, B-C

	A-B	B-C
θ₁₀	16.8898 -2.6398	137.7221 42.2779
θ₂₀	-21.0903 21.0903	-168.7723 168.7723
θ_{1tf}	137.7221 42.2779	149.9268 97.4534
θ_{2tf}	-168.7723 168.7723	-57.0260 57.0260

We will use the angle values $\theta_{10}, \theta_{20}, \theta_{1tf}, \theta_{2tf}$ from Table 2 at the defined points A-B, B-C to plot the respective trajectories k_1, k_2 and k_3 in Table 3.

Table 3. Sizes of angles between points A-B trajectory k_1 , B-C trajectory k_2 and k_3

	A-B (k_1)	B-C (k_2)	B-C (k_3)
θ₁₀	-2.6398	137.7221	137.7221

θ₂₀	21.0903	-168.7723	-168.7723
θ_{1tf}	42.2779	149.9268	97.4534
θ_{2tf}	168.7723	-57.0260	57.0260

An illustration of the arm positions at point B at time t_0 and point C at time t_{fin} can be seen in Fig. 4. The trajectory of the end point during its movement from point B to point C is also depicted in Fig. 4.

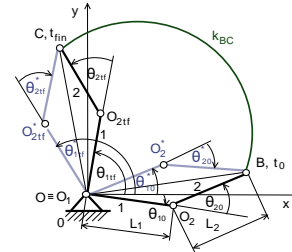


Figure 4. Manipulator model with two arms, displaying angles $\theta_{10}, \theta_{20}, \theta_{1tf}, \theta_{2tf}$, and the trajectory k_{BC} .

Determine the trajectories along which the endpoint will move between the defined points, which will be addressed by solving direct kinematics in the following section.

3 Computer simulation and trajectory

In the Matlab program, we determine the trajectory during the motion of the arms from a position defined by the endpoint of the second arm, starting at point A and ending at point B, using the calculated angles in Table 3. A 5th-degree polynomial will be employed in this process. The solution will yield sequential trajectories k_1, k_2 a k_3 , illustrated in subsequent figures [5-9].

Trajectory k_1 corresponds to the movement of the endpoint from point A to point B (Tab. 1) with initial and final angles given in Tab. 3, as shown in Fig. 5.

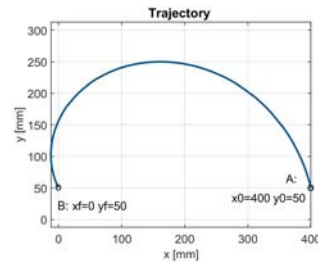


Figure 5. Trajectory k_1 between points A-B.

Along trajectory k_1 , between A and B, the endpoint of the second arm of the manipulator will move, following specified angles of rotation, angular velocity, and angular acceleration, as depicted in Fig. 6.

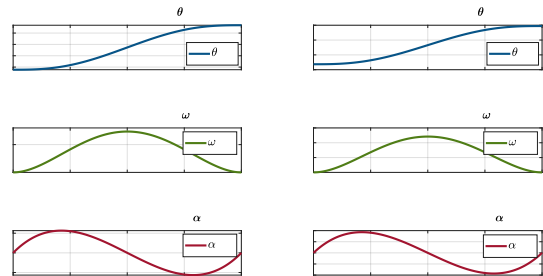


Figure 6. Movement characteristics of the manipulator with trajectory k_1 from point A to point B.

Figure 7 a) illustrates the workspace of the mentioned manipulator Scara. Figure 7 b) illustrates the workspace with angular constraints $-45^\circ \leq \theta_1 \leq 225^\circ$ and $0^\circ \leq \theta_2 \leq 180^\circ$ and the trajectory between points A and B. Fig. 1.

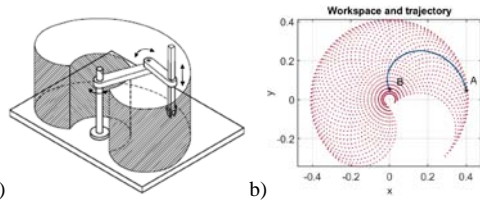


Figure 7. a) The workspace of the manipulator Scara, b) trajectory k_1 between A-B and the manipulator workspace.

The trajectory k_2 from point B to point C, based on the angles listed in Table 3, is shown in Fig. 8 a). The determined trajectory k_3 based on the angles in Table 3 is depicted in Fig. 8 b).

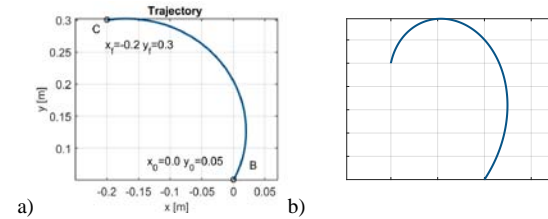


Figure 8. Trajectory a) k_2 between points B-C, b) k_3 between points B-C.

Figure 9 displays graphs depicting the kinematic parameters of the manipulator as the endpoint moves along trajectory k_2 from point B to point C.

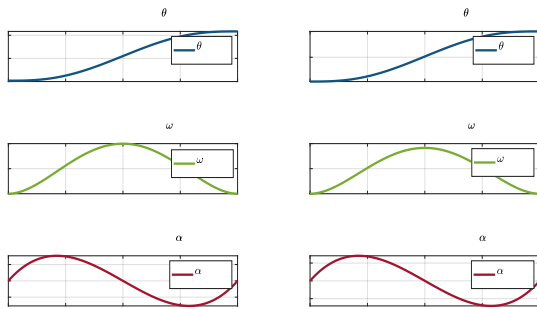


Figure 9. Kinematic parameters of the manipulator for k_2 between B-C.

Figure 10 displays graphs illustrating the kinematic parameters of the manipulator as the endpoint moves along trajectory k_3 from point B to point C.

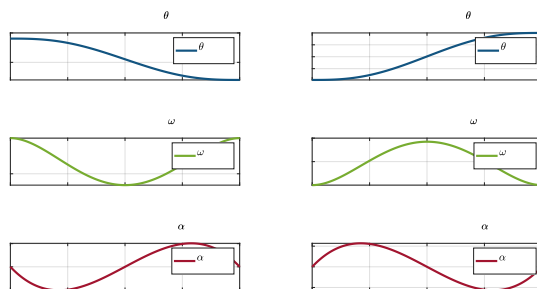


Figure 10. Kinematic parameters of the manipulator for k_3 between B-C.

After solving the forward kinematics in Matlab, Fig. 11 displays the workspace with trajectories k_1, k_2, k_3 , where:

- a) $-45^\circ \leq \theta_1 \leq 225^\circ$ and $0^\circ \leq \theta_2 \leq 180^\circ$,
- b) $-45^\circ \leq \theta_1 \leq 180^\circ$ and $0^\circ \leq \theta_2 \leq 180^\circ$,
- c) $-45^\circ \leq \theta_1 \leq 105^\circ$ and $0^\circ \leq \theta_2 \leq 180^\circ$,
- d) $-20^\circ \leq \theta_1 \leq 105^\circ$ and $0^\circ \leq \theta_2 \leq 180^\circ$,

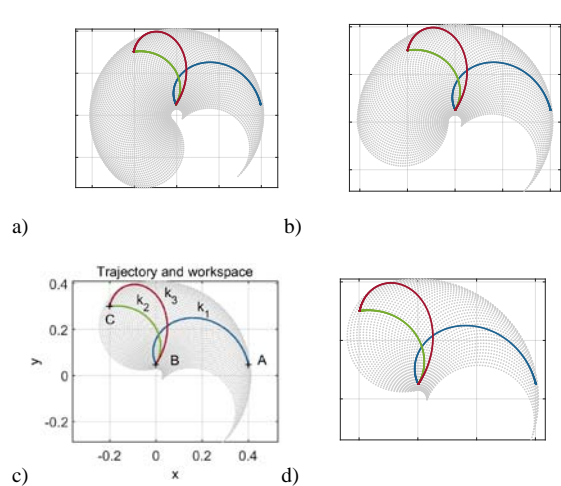


Figure 11. a) - d) Trajectories k_1, k_2, k_3 and the workspace of the manipulator.

Computer modeling of a prototype is a convenient tool for creating, processing, modifying, and presenting simulation results in the form of graphs. Graphs of output variables allow real-time monitoring of measured values during the simulation [5-9].

In multibody modeling software, there is no need to solve the mathematically described motion with a motion equation. We only use information about the geometric parameters of the designed model. An example of a manipulator model is shown in Fig. 11 a) to d), featuring various perspectives of the simulation model in the MSC Adams View software during "multibody modeling" with illustrated end-point trajectories.

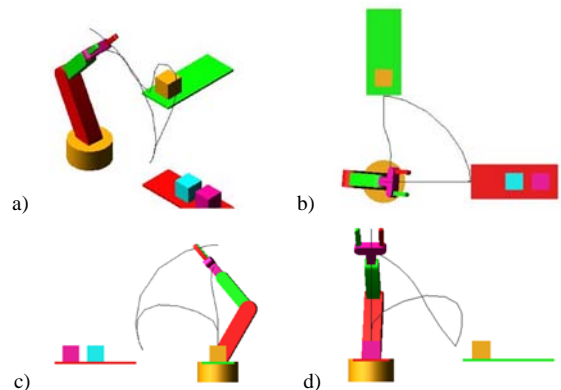


Figure 12. a) - d) The model in motion depicted using MSC Adams View software.

Further works by the authors of the paper are dedicated to modeling in MSC Adams [5-9].

4 Conclusion

Simulation software serves as a useful design tool, saving time and resources. It is also suitable for in-depth research of mechanical systems.

The advantage of computer simulation lies in the ability to simulate the motion of a prototype model and obtain information about the magnitudes of the required kinematic and force variables of the model. Based on simulation results, it is possible to construct an actual model and design drives. When designing drives for a mechanical system, it is essential to consider the maximum forces when manipulating various loads. Hence, designing a drive with specific parameters for the intended use of the manipulator is necessary [10-14].

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Primary Paper Section: J**Secondary Paper Section: JQ, JR, JW, JD**

EVALUATING THERMAL INSULATION PROPERTY OF THE CORRUGATED VENEER BIRCH WOOD PANEL OFFERED TO USE AS A MODERN CLADDING MATERIAL FOR INTERIOR DECORATION

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Abstract: The trend of using natural materials for consumer goods has been increasingly pronounced recently. Construction industry is no exception here, with wooden house construction developing within it rapidly, and board structures utilized on a large scale. Given this, the task of searching for new technical solutions in manufacturing natural material board structures seems a crucial one. The paper describes the patented structure of corrugated veneer panel developed by the authors. Its heat insulating properties are evaluated by finding the thermal conductivity coefficient. Another advantage of the corrugated veneer panel under consideration is its capacity to help expand the scope of use of birch wood, which is currently highly limited.

Keywords: birch, veneer, board material, corrugated veneer panel, natural materials.

1 Introduction

At present, there is a great variety of construction materials designed as boards which are utilized in wooden house construction. For example, among these, there is oriented strand board (OSB), wood fiberboard, wood chipboard, medium density fiberboard (MDF), laminated wood board (plywood), etc. These materials differ in their operational characteristics determined by the production technology. Board materials have found application in house construction, in particular, in construction of partition walls, as framing, surfacing, heat insulating, and other types of materials.

Currently, growth of consumer interest in the use of natural, environmentally friendly materials is observed. Most board materials are essentially composites where elements of wood in the form of chips and sawdust are used as filler, and various resins are used as binder.

The use of sawdust and chips, i.e., smaller wood particles, makes it necessary to apply considerably large amounts of binder, which results in the materials giving off resin vapors in the process of operation, in its turn. So, due to resins in their composition, these materials cannot be called completely sustainable.

This is why there is currently a need of searching for new board materials being both environmentally friendly and manufactured of wood with the minimum amount of adhesives.

A problem of forestry sector consists in the 2022 complete shutdown of exports of birch wood from the Republic of Karelia to Finland bordering on it. This resulted in vast quantities of unclaimed birch wood accumulated within the area of the republic; consequently, timber producers had difficulties selling it.

All the above necessitated looking for new solutions which would help involve birch wood into production, on the one hand, and on the other – create a new product sought after in the wooden house construction market.

During the brainstorm conducted by the staff of the Department of technology and management of forest industry complex at the Institute of Forestry, Mining, and Construction Sciences of Petrozavodsk State University and involving students and postgraduate students, a new board material was proposed named "Corrugated veneer panel" (see Figure 1).

The novelty in design of this board material is confirmed by utility model patent RU 220698 "Corrugated veneer panel" with priority dated 22/05/2023.

This panel is manufactured of birch veneer sheet by placing corrugated sheets between the external and internal flat ones. The panel design uses the minimum amount of adhesive which is applied on flute crests of the corrugated veneer sheets only.

Construction use of this material needed a comprehensive study of its physical and mechanic properties. One of the important characteristics of the material is its thermal conductivity, which is the subject of study of this paper.

2 Literature Review

This research into thermal conductivity needed conducting some experimental studies. In planning of the experiment, the first stage included studying previous experience gained in this domain.

V.P. Lugovaya (2013) cites thermal conductivity data of heat insulating material called "Ecovata Plus". This material is a wool-like mass consisting of fluff cellulose fibers and designed for heat insulation of houses. According to the data of AS Resourse testing laboratory, this material features the following thermal conductivity value at the temperature of 25°C – 0,028 W/(m·K).

I.V. Susoeva, T.N. Vakhnina, A.A. Titunin, and V.E. Rumyantseva (2022) discuss the technology of manufacturing composition heat insulating board material from plant fibers based on using the linen and cotton filament waste and soft waste of wood with thermosetting binder. The data are cited that with carbamide and formaldehyde binder at the 20% volume, thermal conductivity coefficient of the resulting material amounts to 0,05 ... 0,06 W/(m·K).

However, natural heat insulating materials have to compete with artificial materials based on polyurethane or, if strength is a priority, cement.

Jelle B.P. (2011) notes that typical thermal conductivity values of foam polyurethane (PUR) (heat insulator produced in the form of boards) range within 0,02 ... 0,03 W/(m·K). Alongside this, the author highlights that under standard operation, foam polyurethane performs its heat insulating duties and is safe for human health, but it is a major hazard in case of fire, because it emits highly toxic gases when burning (Jelle, 2011).

The work of V.A. Kudryashov, S.S. Botyan, and S.M. Zhamoidik (2019) describes the technique of a series of experimental studies for evaluating effective thermal conductivity coefficient of cement fiberglass-reinforced boards in conditions of fire.

As laboratory equipment to find out thermal physical properties of the construction material, these researchers used the EKPS-10/1300 electric muffle furnace which supports heat modes within the 20 to 1300°C temperature range.

T. Seyitniyazova, A. Orazgulyev, and A. Kashanov (2008) consider the idea of generalization of problems of finding thermal conductivity in plane, cylinder, and spherical walls, i.e., the problems conventionally worded for each geometrical wall shape individually.

The work by A.A. Bakatovich, N.V. Bakatovich, and A.N. Penkrat (2022) describes a number of studies, including one to find thermal conductivity coefficient of crushed pine bark for

optimizing the particle size of structure-forming material in heat insulating boards made with the said bark.

N.V. Kilyusheva, V.E. Danilov, and A.M. Aizenshtadt (2016) point out that for finding thermal conductivity of a pine extract and bark heat insulating material, the probe technique using MIT-1 thermal conductivity meter as per GOST 30256-94 "Building materials and products. Method of thermal conductivity determination by cylindrical probe".

V.A. Kudryashov and S.S. Botyan (2017) discuss various methods of finding thermal conductivity of construction materials. In particular, they look into techniques corresponding to GOST 30290-94, GOST 30256-94, STB 1618-2006, STB EN 12667-2007, and STB EN 12939-2007.

3 Research Methodological Framework

The objective is to evaluate thermal conductivity of corrugated veneer panel of birch wood.

Tasks of the research include:

- to study methods of exploring thermal conductivity of board construction materials used in house construction;
- to find the thermal conductivity of corrugated veneer panel by means of experiments;
- to provide comparative evaluation of thermal conductivity of corrugated veneer panel versus other board construction materials utilized in wooden house construction.

The object of this study is corrugated veneer panel;

Its subject is thermal conductivity properties of corrugated veneer panel.

The following methods were used to achieve the set objective and perform the tasks outlined:

- patent and information search and analysis of scientific technical literature. Using the method, the authors could collect and systemize all the necessary information for the research;
- the comparison method. This method helped conduct comparative analysis of the object of the study and similar materials and reveal their differences. Comparative analysis was conducted proceeding not only from the results of studying scientific technical literature, but also from the data returned by the laboratory-based experiment conducted to find the thermal conductivity coefficient value of corrugated veneer panel.

For the experiment to find the thermal conductivity coefficient value characterizing energy performance of corrugated veneer panel, a set-up was designed, basically representing a box with a source of heat inside and a window in one of the walls.

The window had fasteners to secure the material under study in its opening. Walls of the box were lined with heat insulating material to ensure extra protection against loss of heat.

In the research, samples of the panel manufactured of corrugated birch veneer (Figure 1) were used: their dimensions were 135 x 140 mm, thickness of the samples was 28 mm, which included two corrugated veneer layers with 14 mm flute size.

The heat source was located inside the box and powered from the 220V AC network.

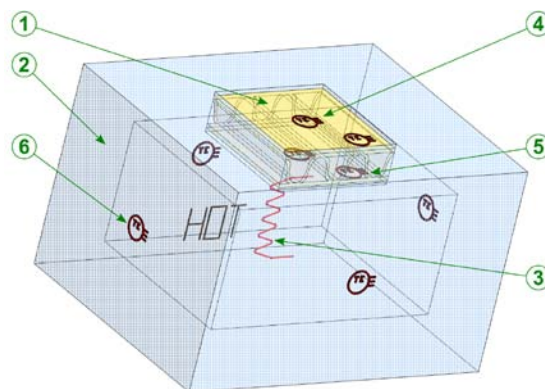
The power of the heat source was 60 W. The ambient air temperature in the laboratory was 21°C during the experiment.

Figure 1 Test Sample of Corrugated Veneer Panel



To measure the temperature of the internal and external wall surfaces of the material under study (facing towards the interior of the box and outside, respectively), as well as to monitor the operation of the set-up and the ambient air temperature in the room, the DS18B20 temperature sensors fitted with a metal sleeve were used (DS18B20 Programmable Resolution 1-Wire Digital Thermometer, 2023). DS18B20 sensors were chosen owing to their reliability, simple operation, and ensured precision of $\pm 0.5^{\circ}\text{C}$ which is sufficient for the experimental conditions within the range of temperatures measured from -10°C to $+85^{\circ}\text{C}$. So, the set-up included: two temperature sensors to measure the temperature of the material wall facing towards the interior of the box; two sensors to take the temperature of the external wall of the material; four sensors for monitoring the temperature on the surface of walls of the box itself; and three more sensors to monitor the ambient air temperature of the room (Figure 2).

Figure 2 Diagram of the Experimental Set-Up



1 – sample under study; 2 – box; 3 – heat source; 4 – temperature sensor located on the external side of the material; 5 – temperature sensor located on the internal side of the material; 6 – temperature sensor located on the box wall

As DS18B20 sensors support the 1-Wire protocol, they were connected to the Arduino microcontroller platform, using which the temperature data were taken from the sensors every second and sent to the laptop outputting them on the screen. In addition, the course of experiments with the materials was monitored using the Testo 875-1i thermal imager which features a high thermal sensitivity (Testo 875-1i - Thermal imager, 2023).

The experiment was conducted in line with the following technique. The tested material was placed in the box window opening, secured, and sealed in the opening. Power was supplied to the heating element, as a result of which the interior of the box

was heated, and the internal wall of the material sample under study was heated, too. Readings of temperature sensors were output on the laptop screen and registered.

Heating was continued until readings of the temperature sensors installed on the wall surface of the tested material stopped increasing and were at a stable value.

With the data obtained, the thermal conductivity coefficient was calculated according to the known formula (Heat engineering experiment, 1982):

$$\lambda = \frac{(Q - Q_w) \cdot \delta}{(T_{W1} - T_{W2})F} \text{ W/(mK)}$$

here Q is the supplied heat flow, W;

Q_w – the heat flow escaping through walls, W;

δ – thickness of the sample, m;

T_{W1} , T_{W2} – temperatures of the internal and external surfaces of the sample, respectively, K;

F – area of the sample, m_2 .

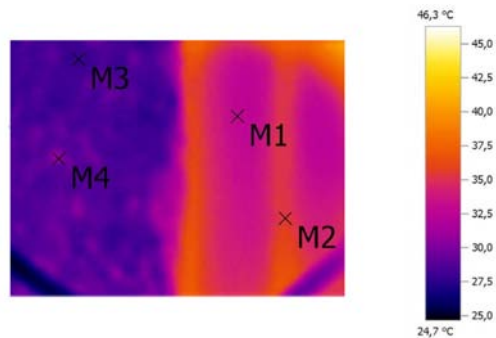
4 Results and Discussion

In the course of the research, the average heating temperature of the internal surface of the panel under study, i.e., the one facing towards the interior of the experimental set-up housing, was 72°C, while the average temperature on the external surface of the panel under study was 34°C during the experiment.

The measurements were stopped as soon as the temperature difference on the external surface of the samples was less than 0,5°C between measurements taken in 120 seconds.

After this, readings of sensors installed on the external and internal walls of the material under study were registered, and readings of the thermal meter were taken (Figure 3).

Figure 3 Readings Registered with a Thermal Imager



M1 – 32,9°C; M2 – 35,5°C; M3 – 27,7°C; M4 – 30,3°C.

The average time for the external sample surface temperature to achieve the steady-state condition amounted to 38,85 minutes.

In the course of the experiment, 812 measurements were conducted in series of four takes. The large sampling size is associated with registering three five-second reports on the ongoing basis at the interval of 120 seconds.

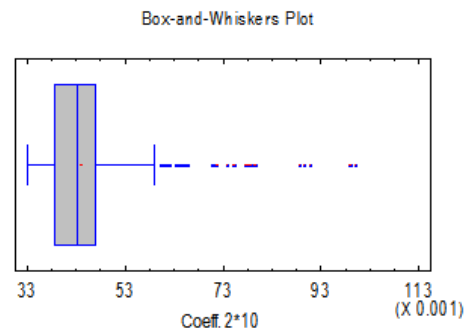
Statistical characteristics of the findings are given in Table 1.

Table 1 Statistical Characteristics of Sampling Obtained by Measuring the Thermal Conductivity Coefficient

Characteristics	Values
Sampling size	812
Average	0.0441951
Dispersion	0.0431595
Standard deviation	0.000676495
Variation coefficient	0.00822493
Standard error	18.6105%
Minimum value	0.000288638
Maximum value	0.0332101
Skewness coefficient	0.00820557
Standardized skewness coefficient	2.41654
Coefficient of excess	28.1123
Standardized coefficient of excess	10.0559

The high values of skewness and excess coefficients suggest a distribution which is different from the normal one. This is explained by including the thermal conductivity values obtained at the early stages of measurement into the general bulk of results. Thus, when constructing the box-and-whiskers plot (see Figure 4), the thermal conductivity values of 0,06 and more should be considered outliers, and there are 31 of them. With this quantity amounting to 3,8% of the sampling, they can be excluded from the research.

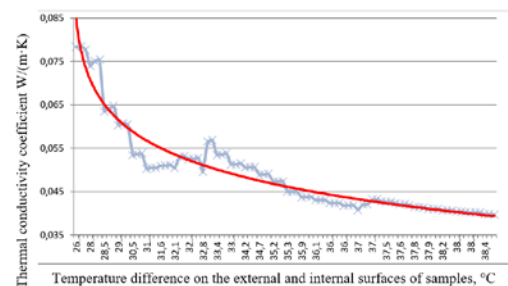
Figure 4 Box-and-Whiskers Plot



In the course of work, graphs have been obtained characterizing the change of thermal conductivity and given in Figure 5 and Figure 6. In the said figures, the grey curve characterizes the averaged values of thermal conductivity for all measurements conducted, and the red solid curve represents the regressional relationship ($R^2 = 93.378$) of change of the calculated thermal conductivity throughout the measurements:

$$\lambda_{\text{exp}} = -0,001 \ln(T_{W1} - T_{W2}) + 0.0085$$

Figure 5 Dependence of Thermal Conductivity Coefficient of the Samples on the Difference of Temperatures on the External and Internal Sample Surfaces



So, the calculated thermal conductivity coefficient value based on regression equation was 0,04043 W/(m·K), while the said coefficient value obtained by tests amounted to 0,03991 W/(m·K).

5 Conclusion

For the research, the experimental set-up was designed, with a system for monitoring temperature inside and outside the set-up. In the course of the research, thermal conductivity of corrugated veneer panel was evaluated. So, its thermal conductivity coefficient value was registered at 0,03991 W/m·K. Findings of the research have demonstrated the possibility of using corrugated veneer panel as an interior-grade facing material. Further on, the authors plan to evaluate sound-insulating properties of the said material, as well as its strength performance.

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Primary Paper Section: J

Secondary Paper Section: JJ, JP

DEVELOPMENT OF PASSENGER CAR SAFETY

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Abstract: The goal of the paper was to assess safety of passenger cars sold in the Czech Republic in terms of the development of both active and passive safety features of cars sold between 2020–2022. Using content analysis aimed at collecting secondary data, the sales of passenger cars and their safety ratings were examined. Cluster analysis and neural networks were subsequently used to classify vehicles into self-organizing Kohonen maps, within which the movement between individual clusters was monitored. It was found that more than 25 % of vehicles sold between 2021 and 2022 changed their position compared to the year 2020. When taking into account vehicles newly introduced to the market, the average level of safety of vehicles sold compared to the year 2020. Further research could focus on a more detailed analysis of factors affecting safety on roads and their quantification for making better predictions and prevention of road accidents. It should be considered that vehicle safety ratings are based on a specific methodology and criteria and can vary significantly.

Keywords: Traffic accidents, vehicle safety, development of vehicle safety, road traffic, safety features, Kohonen maps.

1 Introduction

Traffic accidents represent a significant public health problem affecting both social development and the public safety [1]. The accident rate and fatality rate related to traffic accidents are constantly growing every year all over the world; therefore, considerable efforts are made to prevent traffic accidents [2]. According to predictions, by 2030, traffic accidents will be the 7th most common cause of death [3]. The consequences of traffic accidents can be tragic and may affect not only the victims but also their families and society as a whole. In urban transport, traffic accidents represent the most common and serious risk to people's lives and making vehicles safer is an important means to reduce the fatal consequences of accidents [4]. There are many causes of traffic accidents; besides the human factor, accidents are often caused by technical problems [5]. Car manufacturers and researchers thus focus on the development of car safety mechanisms. Automotive companies thus try to achieve evidence-based primary prevention, which includes the development of positive health behaviour that should prevent adverse health consequences and uses methods that reduce the number of injuries [6]. The development of vehicle safety features plays a significant role in the number of traffic accidents [7]. Governments and legislative bodies use information about the development of passenger car safety for the regulation and setting the requirements for vehicle safety features. The regulation includes e.g., requirements for vehicle testing or obligatory use of safety features, such as ABS [8]. Currently, the most studied subject of research is vehicle automation, in which large investments are made. However, conventional vehicles are equipped with many passive and active safety features [9], and more and more modern passive and active safety features are being developed [10]. The basic element for ensuring passenger safety conditions is the absorption of impact energy by passive safety features of the vehicle body [11]. In addition, passive safety features include seat belts, safety glass, head protection, etc. Vehicles are also equipped with active safety features, which automatically detect the risk of collisions and prevent them [12]. Modern vehicles represent complex systems of sensors, electronic control units and actuators interconnected by various types of networks inside the vehicle, which control and monitor the condition of the vehicle and thus ensure its safer use [13]. Compared to older ones, modern vehicles can be considered safer thanks to the development of safety features [14]. For this reason, it can be assumed that the modernization of vehicles used will reduce the accident rate on the roads.

1.1 Goal of the paper

The goal of the paper is to evaluate passenger car safety sold in the Czech Republic in relation to the development of active and passive safety features in cars sold between 2020–2022.

1.2 Research questions

To answer the first research question, it is necessary to find out how many new cars were sold in the Czech Republic in the last three years and to divide them into groups by models. This enables evaluating the individual models in terms of safety.

RQ1: What was the total number of newly sold vehicles in the Czech Republic between 1 January 2020 and 1 January 2023?

Thanks to answering the first research question, it will be possible to evaluate individual models in terms of safety and assign them a safety rating, which is different for each model.

RQ2: How are these vehicles evaluated in terms of safety?

The last research question aims to find out whether the potential modernization of vehicles has contributed to achieving greater safety for passenger car users as well as pedestrians, who are also affected by safety.

RQ3: Has the modernization of vehicles contributed to achieving greater safety of passenger cars in the Czech Republic?

2 Literary research

Every year, about 1.2 million people are killed and more than 50 million people are injured in traffic accidents worldwide. As a result of urbanization and motorization, the number of traffic accidents is growing dramatically every year [15]. According to [16], traffic accidents represent a serious economic and social problem, given that the number of fatal accidents is still growing both at the national and international levels. [17] believe that information about factors causing accidents can contribute to minimizing the occurrence of traffic accident, if processed properly and used for making further steps that could ensure greater safety [18]. [19] examine factors associated with traffic accidents in South Korea using ratio analysis combined with descriptive analysis in order to identify relevant catastrophic factors. Data on traffic accidents include multi-dimensional dynamic and static factors, such as “people, vehicles, roads, and environment” at the moment of the accident, which is one of the important data sources for traffic improvement [20].

Modern automobiles are equipped with many safety features. ECU units collect diagnostic data from automobile components, such as engines, brakes, etc., which are able to evaluate and in the case of crisis even avert possible threats [21]. For this reason, it is necessary to develop further passive and active vehicle safety features, as both types help to reduce the risk of traffic accidents and increase the safety of drivers and passengers [22]. [10] deal with passive safety features. The simulation of a half-car model using selected algorithms of feedback vibration control, which is subsequently analysed, points to the improvement of driving safety features, such as road holding and vehicle handling. Safety systems and vehicle construction in real traffic accidents are evaluated using destructive crash tests [23]. However, [24] argue that these tests are a complicated, time-consuming, and costly part of the automobile development process and for reducing costs, they propose simulations using the finite element method, which simulates car crashes in a computational way. The formulation of priorities for future road safety strategies requires a supporting analysis to predict the future number of accidents and assess how already implemented countermeasures address the anticipated accident-related problems [25].

Much of the current research and development in the area of vehicle safety is focused on autonomous driving [26]. Nevertheless, [27] argues that the use of autonomous cars is often hindered by various limitations, such as drivers' privacy or high costs related to their deployment. In recent years, a large number of tools have been used to predict the number of traffic accidents in the next period [28].

[29] use a big data mining method for predicting traffic accidents and thus help to take measures for preventing or reducing the number of traffic accidents in advance. They also mention that in recent years, the methods of predicting traffic accidents show low calculation accuracy. [30] state there are many factors affecting the incidence of traffic accidents. However, in the road transport system, there are two major problems in terms of predicting traffic accidents: first, how to evaluate the weight of the impact of individual factors or variables on the accident; second, how to model the prediction process for multiple interrelated variables. The prediction of the number of traffic accidents could be made using various neural networks; the selection of a suitable network depends on specific data and prediction requirements [31]. A convolutional neural network (CNN) is a model of deep feedforward neural network, which uses the principle of deep learning and shows excellent results in many areas of image classification, such as speech recognition, face recognition, movement analysis, and medical diagnosis [32]. A deep learning algorithm based on convolutional neural networks has achieved a number of breakthrough results especially in the field of objective detection [33]. Another option is the application of recurrent neural networks (RNN), which are particularly suitable for time series [34]. Recurrent neural networks are designed in a way so that they converge to the required equilibrium point for their applications [35]. Recurrent neural networks have introduced a directional loop, which is able to remember previous information and apply it to a real output, which is a major difference when comparing them with traditional feed-forward neural networks (FNN) [36]. For example, [37] propose a combination of deep learning method architectures consisting of CNN and long short term memory (LSTM) to analyse spatial and temporal features and predict traffic speed in several steps. In contrast, [38] compared various deep neural networks (DNN), including "deep belief network, standard recurrent neural networks (RNN), multilayer neural networks, and single-layer neural networks in terms of the accuracy of predicting seriousness of accidents involving motorcycles with the finding that RNN outperforms other three models of neural networks. Compared to other architectures, such as convolutional neural networks, recurrent neural networks can suffer extremely from longer fitting and evaluation due to their inherent sample-by-sample data processing, while traditional application of both of these architectures requires a fixed observation interval during both fitting and testing; the ability of recurrent neural networks to process data sample by sample opens space for alternative approaches [39]. The main advantage of RNNs is that they are able to retain information about previous inputs, which enables a better understanding of the context and performance improvement when information in a sequence is interconnected. At the same time, RNNs are able to work with sequenced data [40].

Primary data can be collected using content analysis [41], whose aim is to obtain data on the content of the material analysed and to identify the key elements or topics included [42]. Content analysis is traditionally considered a quantitative method but can also have a qualitative form. However, there is not much available methodological knowledge about the characteristics of qualitative content analysis compared to its quantitative form [43]. [44] describe content analysis as a method often used in scholarly papers and scientific research. The authors point out that the application of this method in the literature shows a lack of details about the method and the results of the analyses. [45] use a combination of content analysis of documentation from various localities in the Czech Republic and using cluster analysis, they try to find out whether there are groups with different approaches to evaluating various parameters. Cluster analysis represents one of the main directions of research in the

field of data collection. Currently, it has spread into all areas and has made significant progress. With regard to the role of cluster analysis in data collection, a cluster analysis algorithm and its application in collecting primary data is proposed [46]. The importance of cluster analysis consists in the possibility to evaluate elements by clustering multiple homogeneous data. The main objective of the analysis is to collect the elements of one homogeneous group into several groups depending on many variables. This type of analysis is used for the reduction of data, making hypotheses and their testing, as well as for predicting and comparing various models [47]. Although the method of cluster analysis has not achieved the same level as e.g., chemometric analysis [48], it will be used for processing primary data obtained using content analysis.

3 Methodology

The data collection is aimed at obtaining information about the accident rate on the roads in the period between 1 January 2020 and 1 January 2023, the number of traffic accidents of diverse severity, the number of deaths and injuries related to traffic accidents, and the total damage caused by road accidents in these three years. For obtaining the statistical data published by the Ministry of Transport, access to an online database (Policie.cz, 2022) will be ensured and data from the Ministry of Transport websites (Ministerstvo dopravy, 2023) will be downloaded. Using quantitative content analysis, the data will be analysed in order to obtain secondary data relevant to the research. The obtained data will be classified using cluster analysis according to individual periods (the years 2020, 2021, and 2022). For these years, there will be found information about the number of traffic accidents in each year, the number of persons killed in each period, the number of seriously injured persons, the number of slightly injured persons, and the total material damage expressed in Czech crowns.

In order to monitor the evolution of the number of traffic accidents on the basis of innovations in the field of vehicle safety over time, it is necessary to obtain the necessary data on the evolution of vehicle safety. The data will be obtained from various sources, as it will be necessary to determine the number of newly registered vehicles in the monitored period. In terms of the development of vehicle safety, it is not necessary to monitor used vehicles, as this data would not affect the results of the study (used vehicles could appear duplicated in the list of newly registered and used vehicles and thus distort the results). The data on the number of newly registered vehicles is available on the Ministry of Transport websites (Ministerstvo dopravy, 2023), in the section of the Road Vehicle Register, which publishes monthly data on both new and used vehicles. The data include the type of the car, category, factory make, engine, fuel, colour, place of registration, etc. For the purposes of the research, it will be necessary to sort this data into the required format using cluster analysis and select relevant information. Only passenger cars will be used, for which the factory make, type and the number of cars sold in the given period will be selected. In order to reduce this large data volume, there will be monitored only the models of which more than 100 pieces were sold in the given period. This will reduce the time necessary for the data collection and processing and distortion of results will be avoided.

An important part of the data collection is the safety rating of individual vehicles sold in the given period. The server (EuroNCAP, 2023) publishes safety ratings of vehicles sold in the European Union. The ratings are created by an organization of German motorists, ADAC, together with the German Ministry of Transport. Using quantitative content analysis, the vehicles will be assigned secondary data concerning safety. This institution classifies vehicles according to make and model, which enables assigning each of the selected vehicles a rating for the safety of the driver of the vehicle, the safety of the passengers, the safety of vulnerable road users, and the rating of active vehicle safety features, which is of particular importance for the purposes of the research. The ratings will be given on a scale from 0 (the lowest one) to 100 (the highest rating). To

obtain relevant data, it will be necessary to assign a current safety rating to each year of vehicle production. For the year 2020, the ratings may be largely different for the same vehicle model in the year 2022 due to the continuous evolution, the introduction of newer models with the same name or face-lift designs in the market.

The data will be processed using neural networks in cluster analysis and Kohonen map analysis.

The process of creating a Kohonen map can be expressed in numbers, where specific values and calculations depend on specific implementation and algorithms used. An example of a simple mathematical representation of creating a Kohonen map is described below:

Initialization:

The assumption is there is a neural network with dimensions $m \times n$.

Random initialization of the weights of the neurons is necessary [49]:

$$W = \{w_{ij}\} \text{ for } i = 1, 2, \dots, m \text{ and } j = 1, 2, \dots, n. \quad (1)$$

Repeated for each input vector from the input dataset:

If x is the input vector, the distances between the input vector and the neuron weights can be calculated as follows:

$$d_{ij} = \|x - w_{ij}\|, \quad (2)$$

where $\|\cdot\|$ is a standard.

The neuron with the shortest distance a is denoted as winner: (i_w, j_w) .

Next, the weights of the winner and the neurons in its neighbourhood need to be updated using the Kohonen rule [50]:

$$w_{ij}(t+1) = w_{ij}(t) + \eta(t) * h_{ij}(t) * (x - w_{ij}(t)), \quad (3)$$

where:

$\eta(t)$ is the learning speed in time $[t]$

$h_{ij}(t)$ is a function determining the degree of the winner's influence on the neighbouring neurons.

The earning rate $\eta(t)$ and the size of the neighbourhood gradually decrease over time.

This way, the weights of the neurons are gradually adjusted on the basis of the input data, thus forming a Kohonen map. The specific values of the learning rate, the function of the function and standard depend on the particular implementation and algorithm used for creating a Kohonen map. This creates a visual representation referred to as a Kohonen map.

After creating a Kohonen map (10x10) and a cluster, the changes in the clusters occurring between 2020 and 2023 will be monitored. If there was any change affecting a position in the Kohonen map, such a change will be denoted "a big change" if the movement is > 2 ; the movement in the interval of > 0 and < 2 ; will be denoted "a small change". If there is no change, it means that none of the vehicles increased or decreased the level of passive and active user protection between the years 2020 and 2023.

For the purposes of the research, the following hypothesis will be formulated:

H0a: In the period between 1 January 2021 and 1 January 2023, at least 25 % of the vehicles sold in the Czech Republic changed their position compared to their initial position in the Kohonen map.

H1a: In the period between 1 January 2021 and 1 January 2023, less than 25 % of the vehicles sold in the Czech Republic changed their position compared to their initial position in the Kohonen map.

The answer to the formulated hypothesis provides information on whether there were any changes in the development of vehicle safety.

4 Results

In the Czech Republic, all traffic accidents to which the police are called are recorded, which enables ensuring accurate results.

Tab 1. Traffic accidents in the Czech Republic between 2020 and 2023

Year	Number of accidents	Deaths	Seriously injured	Material damage	Number of newly registered cars
2020	94794	460	1 807	CZK 6 016 mil.	180 643
2021	99332	470	1 624	CZK 6 718 mil.	199 669
2022	98460	454	1 734	CZK 7 524 mil.	187 708

(Source: Authors according to Policie.cz, 2022)

Between 2020 and 2023, a total of 568,020 vehicles were sold in the Czech Republic, which represents one car for every twenty citizens. As seen in Table 1, there is a correlation between the number of traffic accidents and the number of newly registered vehicles. From the year 2020, the number of traffic accidents grew by an average of 4,500 accidents per year, which is nearly a 5% increase.

Tab 2. List of newly sold vehicles in the year 2020

MAKE	MODEL	2020_NOVE
ŠKODA	OCTAVIA	19 191
ŠKODA	FABIA	16 264
ŠKODA	KAROQ	8 111
ŠKODA	KAMIQ	7 587
HYUNDAI	I30	7 419
ŠKODA	KODIAQ	6 523
KIA	CEE'D	4 482
HYUNDAI	TUCSON	4 451
VOLKSWAGEN	GOLF	4 152
DACIA	DUSTER	3 536
RENAULT	CLIO	3 496
VOLKSWAGEN	TIGUAN	2 622
TOYOTA	YARIS	2 381

(Source: Authors according to Ministerstvo dopravy, 2023)

Table 2 shows an overview of the ten best-selling vehicle makes in the Czech Republic in 2020, with the highest representation of the domestic carmaker Škoda, which took the first four places in the table and appears five times in the table. In 2020, Škoda delivered a total of 60,497 cars on the domestic market. The second best-selling make is Hyundai with a total of 16,989 cars. The third place is occupied by one of the models of Volkswagen, which sold a total of 16,759 (13 models), of which the best-selling model was golf.

Tab 3. Overview of best-selling vehicles in 2021

MAKE	MODEL	2021_NEW
ŠKODA	FABIA	15653
ŠKODA	OCTAVIA	14099
ŠKODA	KAMIQ	10505
HYUNDAI	I30	10307
ŠKODA	KAROQ	9703
ŠKODA	SCALA	8678
ŠKODA	KODIAQ	6258
HYUNDAI	TUCSON	5698

ŠKODA	SUPERB	5224
VOLKSWAGEN	GOLF	4678
KIA	CEE'D	4407
DACIA	DUSTER	3444
SEAT	ARONA	2884
PEUGEOT	2008	2691
VOLKSWAGEN	TIGUAN	2375
TOYOTA	PROACE	2265
TOYOTA	COROLLA	2082
TOYOTA	RAV4	1908
FORD	PUMA	1585
TOYOTA	YARIS	1564

(Source: Authors according to Ministerstvo dopravy, 2023)

Table 3 shows a list of twenty best-selling vehicles in 2021. As in the year 2020, the domestic car manufacturer Škoda is most represented here; compared to the previous year, the number of cars sold grew to 70,854, with a total of 7 models. Hyundai's position in the market was also stronger, selling a total of 20,073 vehicles, which represents an increase of over 3,000 vehicles compared to the previous year. On the other hand, Volkswagen showed a slight decline in the market, as the number of cars sold decreased by 150 vehicles. The year 2021 saw the highest number of newly registered passenger cars in the monitored period, specifically 199,669.

Tab 4. Overview of newly sold vehicles in 2022

MAKE	MODEL	2022_NEW
ŠKODA	OCTAVIA	13988
ŠKODA	FABIA	13275
HYUNDAI	I30	8255
ŠKODA	KAROQ	8005
ŠKODA	KAMIQ	6926
ŠKODA	SCALA	6529
ŠKODA	SUPERB	6467
ŠKODA	KODIAQ	6401
HYUNDAI	TUCSON	5817
DACIA	DUSTER	4046
VOLKSWAGEN	GOLF	3152
TOYOTA	YARIS	3037
DACIA	SANDERO	2599
TOYOTA	PROACE	2471
KIA	SPORTAGE	2281
TOYOTA	COROLLA	2184
TOYOTA	RAV4	2116
CUPRA	FORMENTOR	1998
SEAT	ARONA	1955
FORD	KUGA	1797

(Source: Authors according to Ministerstvo dopravy, 2023)

As seen in Table 4, the year 2022 was worse in terms of sales compared to the year 2021, as the decrease in the number of cars sold was more than 12,000. The first three positions are again occupied by Škoda, Hyundai, and Volkswagen. Škoda occupied the first position with a total of 62,247 cars sold, which is a decrease of more than 8,000 cars compared to the previous year. A decrease was also recorded in the case of Hyundai, which sold 1,230 vehicles less than the previous year. Similarly, Volkswagen sold more than 4,000 cars fewer, and its position was occupied by Toyota, which sold a total of 12,162 vehicles.

Tab 5. Overview of cars sold by car manufacturers in the CR between 2020 and 2022

MAKE	2020_NEW	2021_NEW	2022_NEW
ŠKODA	60497	70854	62247
HYUNDAI	16989	20073	18387
TOYOTA	7843	10326	12162
VOLKSWAGEN	16759	16609	12065
DACIA	9747	4161	7324

MAKE	2020_NEW	2021_NEW	2022_NEW
FORD	6642	5578	7276
KIA	7127	9732	6552
MERCEDES-BENZ	5790	7941	6387
BMW	4478	4414	3886
OPEL	2251	4449	3762
RENAULT	7220	2624	3753
PEUGEOT	7455	7633	3716
SEAT	4237	6306	3700
CITROEN	4473	4055	2740
AUDI	1834	2123	2654
SSANGYONG	160	923	2341
VOLVO	1900	2410	2168
MAZDA	1646	2343	2002
SUZUKI	2379	2442	1877

(Source: Authors according to Ministerstvo dopravy, 2023)

Table 5 shows sales by individual car manufacturers. As can be seen from the table, Škoda has the largest presence on the domestic market and its sales exceed the sales of other car companies several times over. The second most successful make in the Czech market is Hyundai, which occupied the second place in every year of the monitored period, followed by Volkswagen (third place), Toyota (fourth place), and the Romanian car manufacturer Dacia (fifth place).

Important information is the data about the safety of the vehicles sold. For this reason, content analysis was used to obtain data on the ratings based on the results of crash tests performed for each of the models. On the basis of the ratings, neural networks were used to sort the cars into a Kohonen map, where each model was assigned a specific position (see Table 6). The changes in the positions represent changes in the vehicle rating.

Attachment1 shows a list of selected vehicles with information about the year of manufacturing, the model, the number of pieces sold in a given year, driver's safety, passenger safety, pedestrian safety, active safety features, neuron ID, and the position in the Kohonen map. The last column shows if there have been any changes. For simplicity, this table does not contain vehicles for which no change has been recorded.

It can be seen that there were changes; however, the results in this table are skewed for the above reason. The table presents predominantly major changes, which apply to the best-selling models, such as Škoda Octavia, Volkswagen Golf, and Kia Cee'd. Škoda Octavia changed its position twice, from (10,5) in 2020 to (8,8) in 2021 and (8,7) in 2022. In contrast, the position of one of the best-selling models, Hyundai I30, did not change during the whole monitored period. Another big change can be seen in the case of Dacia Duster, whose position changed from (1,10) in 2020 to (3,8) in 2022.

Tab 6 Average values in the years 2020, 2021 and 2022

Year	Driver's safety	Passenger safety	Pedestrian safety	Active safety features	Average value
2020	87.59	81.92	65.56	64.62	74.93
2021	89.27	85.94	71.38	70.43	79.25
2022	88.28	82.78	70.58	70.85	78.12

(Source: Authors)

As seen in Table 6, the safety features of passenger cars sold in the Czech Republic underwent considerable development from the beginning of the monitored period. The table shows the values of the average vehicle sold in a given year. In 2020, the average passenger car showed the following values: 87.64 for driver's safety, 81.92 for passenger safety, 65.56 for pedestrian safety, 64.62 for active safety features; the overall average value for the vehicle was 74.93. With the gradual evolution, the values recorded in 2022 were 88.28 for driver's safety, 82.78 for passenger safety, 70.58 for pedestrian safety, 70.85 for active safety features; the overall average for the vehicle increased by more than 3 points, reaching 78.12.

In 2021, a total of 199,669 cars were sold, out of which 43,118 vehicles changed their position in the Kohonen map compared to the situation in 2020. In 2022, a total of 178,708 vehicles were sold; 53,145 changed their position on the Kohonen map. Based on these results, it is possible to accept the null hypothesis:

H_{0a}: In the period between 1 January 2021 and 1 January 2023, at least 25 % of the vehicles sold in the Czech Republic changed their position compared to their initial position on the Kohonen map.

Out of 378,377 vehicles sold, 96,263 changed their position on the Kohonen map = 25.44 % > 25 %. The alternative hypothesis H_{1a} is thus rejected.

5 Discussion

RQ1: What was the total number of newly sold vehicles in the Czech Republic between 1 January 2020 and 1 January 2023?

The number of cars sold in the Czech Republic in the last three years has evolved to a large extent. Between 2020 and 2022, there was a gradual increase in the number of traffic accidents, although the number of newly registered vehicles decreased. These findings show that an increase in the number of vehicles on roads can have an impact on the safety situation and increase the risk of traffic accidents. For this reason, it is necessary to develop safer vehicles. The year 2022 saw a slight decrease in the number of cars sold. This could be due to the high inflation and financial crisis in the Czech Republic, as confirmed also by [51], who attributes this crisis to the war in Ukraine.

As seen in Tables 2, 3, and 4, Škoda is the dominant make in the market of new car sales; it is also the best-selling make and has the most models in the list of best-selling vehicles. This confirms the strong position and popularity of Škoda with Czech motorists. In the last three years, Škoda has sold more than 190,000 cars; as [52] believe, this is due to the fact that the Czech Republic has revived and supported its automotive industry, which has led to increasing the production and export of cars.

There was a significant increase in the sales of Hyundai vehicles. The figures show that Hyundai increased the number of cars sold in the monitored period, which indicates the growing popularity of this make among Czech customers. This trend may be attributed to the supply of competitive models with a good price/performance ratio as well as the credibility of the brand.

The last finding is the decrease in the number of Volkswagen cars sold in the year 2022. Table 5 shows that Volkswagen dropped to fourth place in the number of cars sold, while in the previous years, it occupied third place. This could be attributed to many factors, including the competition (other makes), changes in customer preferences, or new models on the market.

RQ2: How are these vehicles evaluated in terms of safety?

The vehicles are assigned a score according to EuroNCAP rating (EuroNCAP, 2023) in four categories: driver's safety, passenger safety, pedestrian safety, and active safety features. Based on these criteria, TESLA model Y achieved the best rating, with values of 97, 87, and 82. The best score was achieved in the case of active safety features (98). It is thus a very safe vehicle; however, in 2022, only 184 of these luxury cars were sold in the Czech Republic. This model is followed by models such as LEXUS RX450H, Mercedes-Benz model A, Volvo XC90, and Volkswagen Arteon.

This is also confirmed in the study by [53], who argue that vehicle safety varies depending significantly on vehicle size. More expensive cars are usually equipped with advanced safety technologies and systems that minimize the risk of accidents and protect both the driver and the passengers, as well as other road users. These vehicles are also often equipped with modern driver assistance systems, such as adaptive cruise control, lane

departure warning, emergency braking, and blind spot monitoring system. In contrast, vehicles with lower prices usually do not have such a range of safety features. They may lack advanced systems that would minimize the risk of collisions and provide protection in accidents. These cars typically have lower quality construction and materials, which can affect their crashworthiness.

Cheaper cars, such as Fiat Panda, Dacia Duster, Dacia Sandero, or Renault Clio showed the worst results, which is mainly due to the fact that these car manufacturers try to produce affordable vehicles and pay more attention to the vehicle price rather than vehicle safety features. Autonomous cars, which are the future in terms of road safety according to [54], are usually much more expensive than conventional passenger cars produced for the lower and middle class. This is confirmed by [55], who mention the costs of producing autonomous and electric vehicles.

In the Czech Republic, the best-selling models of Škoda have achieved relatively high ratings. The best-rated model of Škoda was the Škoda Rapid with an average score of 82.25 points. Its production, however, was discontinued and the model has been replaced by the Škoda Scala, which achieved the same ratings, although the number of points for the category of pedestrian safety was fifteen points less compared to the Škoda Rapid. The Škoda Octavia and Škoda Fabia achieved higher average values; in 2021, vehicle safety score achieved 83 points on average.

RQ3 Has the modernization of vehicles contributed to achieving greater safety of passenger cars in the Czech Republic?

Based on the changes in the positions in the Kohonen map, it can be stated that vehicles have evolved in recent years in terms of safety.

The authors agree with [26], who stated that the development of vehicle safety plays a significant role in the number of traffic accidents, as the results indicate that although e.g., in the year 2021, the number of sold vehicles grew by 10 % compared to the situation in the year 2020, the number of traffic accidents grew by 5 % only. The same trend can be seen in the year 2022 when a 3.6% increase in the number of accidents was recorded, while more than 10 000 vehicles were sold. However, this indicator needs to be monitored in the long term, as according to the Association of Car Importers [56], more than 6,425,000 vehicles are registered in the Czech Republic. Newly registered vehicles (2020-2023) thus represent only 10 %.

Despite the growing number of traffic accidents, the number of serious injuries and deaths in traffic accidents shows a different trend. In 2020, 460 deaths in traffic were recorded in the Czech Republic; in 2022, it was 6 deaths fewer. As the number of registered vehicles is growing, there can be seen a link between the modernization of vehicles and their safety. This could be demonstrated by the number of serious injuries, which shows a downward trend despite the growing number of vehicles as well as traffic accidents. It is thus possible to agree with [22], who state that active safety features of vehicles contribute to reducing the risk of traffic accidents and protecting drivers and passengers.

The development as such can be described as positive, since compared to the year 2020, the rating of the average vehicles sold in the years 2021 and 2022 increased. In 2020, the average safety value of a vehicle was calculated at 74.93, which grew to 79.25 in 2021. This can be linked to the trend of best-selling cars in the Czech Republic. The rating of the best-selling model, the Škoda Fabia, increased by two points, while the rating of the second best-selling model, the Škoda Octavia, grew by 14 points. The change in ratings caused by introducing a new model in the market resulted in a higher safety score in 2021.

In contrast, the year 2022 showed a decrease in safety compared to the previous year. The rating of the average vehicle was 0.9 points fewer than in the previous years. Again, this was due to the changes in the safety features of best-selling models. Škoda

added a face-lift to its best-selling vehicle, the Octavia, which achieved a lower safety rating than the previous version and extended the sales with the RS version.

6 Conclusion

The goal of the paper was to assess the safety of passenger cars sold in the Czech Republic in terms of the development of active and passive safety features between 2020-2022. To achieve the goal, research questions and hypotheses were formulated and answered.

The paper analysed the trend of traffic accidents in the Czech Republic between 2020 and 2023 and its correlation with the number of newly registered vehicles. The results show that there is a demonstrable correlation between these two factors.

Furthermore, the best-selling car makes and models in the Czech Republic in the period 2020-2022 were examined. The make with the highest representation was Škoda, which dominates the domestic car market. Hyundai came second, followed by Volkswagen and Toyota. Vehicle safety was assigned a score from 0-100, which showed that higher class vehicles achieve higher safety ratings, while lower class vehicles are less safe for their users and public. The findings are significantly influenced by the development of safety features in the Škoda automotive company, whose share in the total number of cars sold in the Czech Republic is more than 35 %. In the monitored period, Škoda launched upgraded models of the Octavia and Fabia and new models, Eniaq and Scala, which achieve high safety ratings. However, the research has confirmed the existence of differences between individual automobiles and their safety features. Some models show a decrease in some categories, especially in the category of pedestrian safety. This may indicate that despite improvements in the categories of driver's and passenger safety, manufacturers still need to focus on improving the protection of pedestrians.

The results obtained show that although there is an evolution in terms of vehicle safety, a more modern version of the same model does not necessarily mean higher safety. This has also been confirmed by the results of the analysis performed, which showed that the average vehicle showed better safety ratings in 2021 than in 2022.

The results of this paper show the importance of monitoring the trend in the number of traffic accidents, sales, and vehicle safety ratings. This study contributes to a better understanding of the links between these factors and can be used as a basis for formulating road safety measures. Further research could be focused on a more detailed analysis of factors affecting road safety and their quantification for better prediction and prevention of road accidents. The results can also have important implications for consumers, as available information on car safety ratings enables them to make an informed decision when choosing a new car.

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K MILITARISM

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EXPERT INSTITUTE AS A TOOL FOR OBJECTIFYING THE MILITARY ACQUISITION PROCESS

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Abstract: The acquisition process of military equipment, technology, material and related services (METMS) is often accompanied by doubts about the economy of the purchase. For this reason, on the one hand, there are delays in the implementation of strategic investments, and on the other hand, there are risks of criminal prosecution of the persons involved. At the same time, the absence of the ability to objectively assess the effectiveness of the entire investment is felt. As a result of the existence of this gap, the project "Znalec" (Expert Witness) was created as a part of the Defense Research Program with the aim of assessing the possibility of creating an expert institute, which could be a professional workplace with the ability to provide an objective view of the value of acquired METMS, create an expert standard for evaluating METMS and design a system of training relevant experts. This paper deals with the first of the goals of the project, when, based on a thorough analysis, it presents a proposal for the parameters of the expert institute, the primary goal of which is to ensure an independent evaluation of the METMS.

Keywords: Expert witness institution, valuation, price, military equipment, combat vehicles

1 Introduction

The acquisition process (procurement process) in military equipment, technology, material and related services (METMS) within the Ministry of Defense of the Czech Republic (MoD) is implemented in accordance with the principles of economical, efficient and effective spending of public resources (MoD, 2015). However, it is often also the subject of political negotiations, and thus also the attention of the media and the public, as part of the public control of the armed forces. Any error or even if only a hint, they are often the subject of investigations by law enforcement authorities.

It is clear, however, that the army needs to ensure continuous renewal, innovation and development of METMS for its effective operation, which is done mainly in the form of an acquisition process (MoD, 2013). The acquisition process can greatly affect not only the technical level of the purchased METMS items, their quality and price, but it can also bring, and unfortunately often brings, a number of risks for MoD and specific parties involved, including personal ones in the form of years-long criminal prosecution or "just" ostracism.

From the above, it follows that the acquisition process or the public contracts that are carried out within it, under the conditions of the MoD, can be considered a highly media sensitive topic (MoD, 2023a). The acquisition process is often accompanied by questioning, and its results are also questioned (Wong et al. 2022a). For this reason, there are significant delays in the implementation of strategic acquisitions, which do not make it possible to use previously prepared resources of the state budget for the acquisition of new military equipment necessary to ensure the required capabilities of the Army of the Czech Republic (ACR) and its development (MoD, 2021).

One of the factors that can help minimize these negative aspects accompanying significant acquisitions in the conditions of the defense departments of the EU member states is the reviewability and provenance of the own valuation of combat equipment and armaments (European Union, 2023). The same applies to the conditions of the Czech MoD. This results in the identified need for valuing METMS in the entire life cycle, which includes past, present and future developments in the

economic security of the MoD. The need to examine the parameters of weapon systems is by no means a new approach.

The importance of testing and evaluation in the development of major weapons systems is already discussed more than fifty years by the US General Accounting Office (1972), where the testing of new weapons is a key element in the acquisition process of weapons systems. It mainly deals with engineering testing, acceptance testing and operational suitability testing. The Army Materiel Command (1987) introduces revised version of the handbook for the acquisition process effective management. It contains key material acquisition policies and also focuses on a simplified acquisition process. Trends and challenges in the defense acquisition process are described in a recent RAND Corporation study (Wong et al. 2022b). Also included here are geopolitical changes, globalization, changes in national priorities, and challenges associated with advanced commercial technologies.

The emergence of the "internal debt" of the MoD (MoD, 2022a), the conclusions of the NATO summit in Wales (MoD, 2022b), the unstable security situation and favorable economic conditions resulted in a gradual increase in defense spending, including the budget of the MoD. The target amount of 2% of GDP for defense spending in 2024 is already realistic from today's point of view (MoD, 2023b). The ability to value combat equipment, military equipment and material must be perceived as necessary not only from an economic point of view (obtaining the so-called value for money), but also from a political point of view, when the MoD must be able to prove that the purchases made were realized at an adequate and acceptable price.

Following the effectiveness of Act No. 254/2019 Coll., on experts, expert offices and expert institutes, the need for expert skills was identified primarily for the benefit of the MoD in the fields of: (1) economics; (2) protection, defense and security; (3) pyrotechnics, ammunition and explosives, and (4) weapons and ammunition. For the reasons described above, MoD initiated the creation of a research project called "Znalec", the content of which, after further clarification, was finally approved in the following points:

1. assessment of the possibilities of establishing an expert institute, in the sense of Act No. 254/2019 Coll., in the conditions and primarily for the needs of the MoD, or ACR;
2. development of a methodical procedure for the evaluation of military equipment in the conditions and primarily for the needs of MoD, or ACR;
3. the creation of a proposal for an educational activity, in the sense of Act No. 254/2019 Coll., for the education of experts in the field of Economics, the sector Valuation of combat equipment and military equipment.

This article deals with the summary of the research in the part of solving the first point, i.e. the assessment of the possibilities of establishing an expert institute, in relation to the identification of needs and the focus of its activity. The results of the research in the areas of its organizational support and the legal form of the expert institute, as well as the research focused on the other two points, will be described in other articles.

2 Research goals and methods

The research goals are to perform an analysis of the need for the creation of an expert institute in the sense of Act No. 254/2019 Coll. and analysis to define the strategic framework of its activity. At the same time, we leave the organizational integration and its legal form for further investigation. To conduct the research, the following research questions were set:

1. Is the establishment of an expert institute necessary to improve the transparency of the acquisition process?

2. What are the identifiable opportunities and threats, strengths and weaknesses of the institution under consideration?
3. What should an expert institute ensure and what should it have at its disposal?

To achieve the research goals, strategic analysis methods adapted to the specifics of the research task are used:

1. analytical part;
2. design part;
3. confrontation of the proposal with SWOT (checklist).

The individual parts of the analysis and proposal were processed iteratively, more in a step-by-step manner, as the strategic delimitation of the expert institute changed with the development of research processing and thus the need for breadth and depth of analyses. This means that the process of processing individual parts repeatedly called for the need to expand and supplement already processed parts, see Fig. 1. This fact is induced by the fact that, unlike normal strategic analyses, which usually follow on from the definition of a strategic framework, the strategic framework is only research wanted.

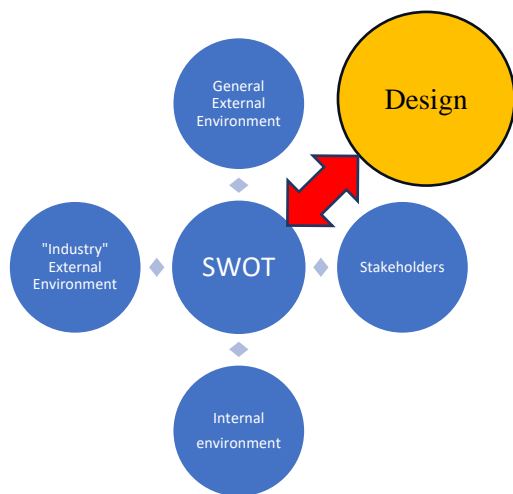


Figure 1. An iterative process of analysis and design

The specificity of the investigated problem lies in the certain interconnectedness of the general and sectoral environment and stakeholders, as the MoD is part of both the government sector, belonging to the general environment, and the sectoral environment, as it is an important, dominant "customer" and one of the most important stakeholders (Retter et al., 2021). This is reflected in the analytical and design part by the perception of its triple role, i.e. in each part with different accents.

2.1 Analytical part

Corresponding with the Fig. 1 the analytical part is divided into sub-analyses as follows:

1. analysis of the general environment;
2. analysis of the industry environment;
3. stakeholder analysis;
4. analysis of the (considered) internal environment.

Tab. 1 clearly shows the structure of the analyses.

Table 1: Structure of the performed analyses

Type of analysis	Selected type of analysis	Output	Summary of analyses
External Factors	General	SLEPT/ MAP	SWOT
	Industry	Porter's five-factor model	
Stakeholders	Stakeholder analysis	S, W, O, T	
Demand	Product, quantity	S, W	

Internal factors	It is not done in this article, as the internal environment is the subject of the design (some aspects are included in the stakeholder analysis)
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2.1.1 Analysis of the general external environment

The analysis of the general environment was carried out in the SLEPTE structure, similar to the PESTLE analysis (Cawman & Liu, 2020), where the following aspects are analyzed:

- Social;
- Legislative;
- Economic;
- Political;
- Technological and
- Ecological.

The MAPI method (Pospisil & Fric, 2016) was used for the analysis, i.e. Monitor, Analyze, Predicate and Identify. The result of the analysis of the general external environment are opportunities and threats that can significantly influence the activities of the intended expert institute.

2.1.2 Analysis of the industry external environment

Porter's model of forces was chosen for the analysis of the industry environment (Porter, 1996, Paksoy et al., 2023). The model takes in to account the following five forces:

1. Power of Customers,
2. Power of Suppliers,
3. Threat of Substitutes,
4. Barriers to Industry Entry and
5. Industry Rivalry.

The result of the analysis of the industry external environment are opportunities and threats that can significantly influence the activities of the intended expert institute.

2.1.3 Stakeholder analysis

The stakeholders are taken as entities that will have some interest in the expert institute, or the expert institute will have an interest in their interest. Stakeholders and their attitudes can differ significantly in the type of institutional arrangement chosen. They may or may not have ownership stakes or direct influence in it. Stakeholders can be owners, customers, employees, management, media, political parties, etc.

Stakeholder analysis begins with stakeholder identification. For each of them, their expectations and goals are analyzed. The analysis results in the identification of strengths and weaknesses and opportunities and threats. The analysis scheme is shown in Fig. 2.

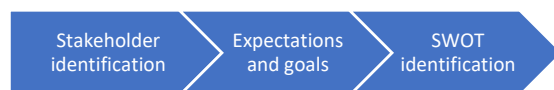


Figure 2: Structure of stakeholder analysis

2.1.4 Demand analysis

The demand analysis was carried out through communication with potential contractors of expert opinions from individual departmental components, both on the basis of a written approach and three conducted workshops. The structure of the analysis is carried out in the manner shown in Fig. 3.

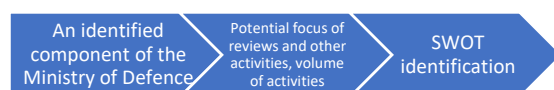


Figure 3: Structure of the analysis of the demand for the expert institute

2.1.5 Analysis of the internal environment

Analysis of the internal environment in the case of the institution does not yet exist, or its sources and status are only the subject of the proposal, it is not presented in this article, although it is outlined in the project outputs.

2.1.6 Summary of the analytical part

The summary of the analytical part is carried out in the project solution in a SWOT table, where individual identified strengths and weaknesses, opportunities and threats are summarized. In this article, the summary is presented only in the "Design" section, where it is confronted with the design of the intended institution.

Identified strengths and weaknesses, opportunities and threats are also confronted in the outputs of the project in accordance with NATO practices using the DOTMLPFI method of developing strategic capabilities (Eaton et al., 2016), where they are assigned according to their relevance to individual points (Correia, 2019):

- Doctrine: doctrinal area, availability of processed regulations and norms;
- Organization: definition of organizational issues;
- Training: opportunities for training and education of personnel;
- Material: availability of material and technical facilities, including logistics services;
- Leadership: possibilities and approaches to the management of the organization;
- Personnel: human resources, suitably prepared, interested in the given organization and given work;
- Facility: sufficiently developed background, for predictable needs and enabling the solution of international projects;
- Interoperability: sharing experiences, approaches and procedures in the processing of expert opinions and evaluation of price and cost of living.

2.3 Design part

The design part is carried out by a modified McKinsey 7S method (Rasiel & Friga, 2001, Pospisil & Fric, 2016), in which the framework of the intended institute is described by a value-based management model (VBM). It describes how a company can be organized holistically and effectively. The model consists of the following seven elements, see Fig. 4:

1. Shared values: the connecting center of McKinsey's model; what the organization stands for and believes, its central beliefs and attitudes;
2. Strategy: plans for allocating a firm's limited resources over time to achieve set goals. Environment, competition, customers;
3. Structure: management method;
4. Systems: procedures, processes and routines that characterize how important work needs to be done: financial systems; recruitment, promotion and performance appraisal systems; Information Systems;
5. Staff / team (employees): in this section, not only employees are considered, but the entire team that will participate in the institute's activities;
6. Style: the cultural style of the organization and how key managers behave in achieving the organization's goals. Management styles; and
7. Skill: characteristic abilities of personnel or the organization as a whole, basic competence.

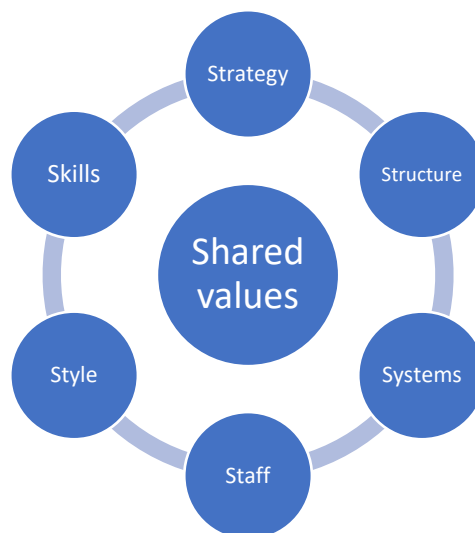


Figure 4. Structure of the design part based on the McKinsey's model

3 Research results – Analytical part

The breakdown of the analytical part corresponds to the structure described in the chapter 2.1.

3.1 Results of the analysis of the general external environment

The results of the SLEPTE analyzes are presented by the MAPI method in Tables 2 to 6.

3.1.1 Social factors

Social factors, i.e. factors characterizing demographic development, age profile, level of health, provided health services or gender factors were not identified as significant from the point of view of establishing the institute. The exception is social factors in the context of job stability and income from expert work. These are listed in Tab. 2.

3.1.2 Legislative factors

The analysis of legislative factors identified a whole range of regulations that must be taken into account when establishing the institute and shaping its strategy. In addition to Act 254/2019 Coll., on experts, expert offices and expert institutes (ZnalZ) and implementing regulations (decrees) following it, these are mainly laws regulating the valuation of METMS.

Table 2: Social factors

M – Monitor	A – Analyze	P – Predict	I – Identify
Job stability	A significant part of the population prefers stable employment with an employer with a clear strategy and growth perspective.	In the long term, this view of employment can be expected to remain unchanged.	T01: Expert institute strategy not providing a clear career development perspective, incl. financial stability and the nature of the work, may cause disinterest to work for such an institution, both initially and over time
The amount and focus of processed expert opinions	According to "Demand analysis" section, it is clear that the need for expert opinions in MoD depts. fluctuates considerably and at the same time their focus changes significantly, which requires very flexible	Fluctuations in the acquisition process can also be expected in the future, and thus greatly changing requirements for the amount and focus of assessments.	T02: Difficulty maintaining a portfolio of experts capable of processing ad hoc assessments in various specialties when their workload is highly variable.

	changes in the team of experts who process the opinions.		
	Suitable experts are not available Reluctance of forensic experts to implement small-scale contracts for determining the usual price	If a systemic solution is not found, the situation will persist and the problem will worsen.	O01: The creation of an expert institute can stabilize the portfolio of experts and the coverage of expert fields for the needs of MoD

The obligation to value METMS results from Act No. 219/2000 Coll., on the property of the Czech Republic and its behavior in legal relations (ZMS), and also from Act No. 320/2001 Coll., on financial control in public administration (ZFK), Act No. 134/2016 Coll. (ZVZ), on awarding public contracts, Act No. 563/1991 Coll., on accounting, etc.

ZnalZ in § 28 paragraph 5 requires that the expert report be processed in accordance with generally accepted procedures and standards of the given field and industry; these standards for the analyzed area of valuation are not available, therefore it is necessary to create and codify them. The requirements for the standard result from the following regulations and related documents:

- pricing law:
 - Act No. 526/1990 Coll., on prices (ZOC);
 - Act No. 151/1997 Coll., on property valuation (ZOM);
 - Regulation No. 441/2013 Coll., on the implementation of ZOM, so-called Valuation Regulation (VOC);
- related valuation standards:
 - International valuation standards with effect from January 31, 2022. (IVS);
 - KLEDUS, R., M. SEMELA, M. BELÁK and P. MAREŠ. Expert standard No. I/2022: valuation of road and special vehicles. Brno: Akademické nakladatelství CERM, 2021. (ZS No. I/2022);
- others, e.g.:
 - Act No. 219/1999 Coll., on the Armed Forces of the Czech Republic (ZOS);
 - requirements for an expert opinion and the procedure for processing an expert opinion;
 - https://www.mfcr.cz/assets/cs/media/MFCR_2014-09-25_Komentar-k-urcovani-obvykle-ceny_v02.pdf (issued before 1/1/2021, when some ZOM changes took place; some principles described in the commentary, in an amended form, they were directly reflected in the text of the ZOM and its implementing VOM);
 - Opinions on the State Property Act, Ministry of Finance of the Czech Republic, 2021 (mfcr.cz);
 - Methodology 2021: Opinion on dealing with the permanently unnecessary movable property of the state. Ministry of Finance of the Czech Republic (mfcr.cz);
 - Methodology 2021: Methodological opinion on free transfer and sales premium. Ministry of Finance of the Czech Republic (mfcr.cz)
 - RMO No. 66/2012 MoD Bulletin, Activity and Development Planning in MoD;
 - NVMO No. 66/2019 MoD Bulletin, Accounting in MoD;
 - RMO No. 27/2018 MoD Bulletin, Financial control within the scope of MoD;
 - NVMO No. 28/2018 MoD Bulletin, Performance of financial control within the scope of MoD;
 - NVMO No. 67/2014 MoD Bulletin, Life Cycle Management of the Cost Center of MoD;

- NVMO No. 46/2015 MoD Bulletin, Securing the budget process and the preparation, implementation and evaluation of programs and actions within the competence of MoD;
- RMO No. 25/2004 MoD Bulletin, Cataloging of assets under the jurisdiction of MoD;
- RMO No. 48/2013 MoD Bulletin, Management and management of property under the jurisdiction of MoD;
- NVMO No. 51/2013 MoD Bulletin, Procedures in the management and handling of property under the jurisdiction of MoD;
- RMO No. 72/2012 Bulletin of the Ministry of Finance, Financial management and financial security;
- Methodological instruction for entering and evaluating opinions according to Act No. 36/1967 Coll., on experts and interpreters, as amended, in MoD (No. 86-28/2016-8201);
- NVMO No. 47/2017 MoD Bulletin, Market research for the support of the acquisition process in MoD;
- RMO No. 55/2017 MoD Bulletin, on the acquisition of property, services and construction works in MoD;
- NVMO No. 60/2017 MoD Bulletin, on a uniform procedure for the acquisition of property, services and construction works in MoD;
- A uniform procedure for determining the price at the usual place and time. Prague: Economic Section of the MoD, 2018;
- NVMO No. 51/2013 MoD Bulletin, procedures for managing and handling property under the jurisdiction of the MoD;
- Draft NVMO Life Cycle Cost Estimates to support the acquisition process in MoD.

Legislative factors are summarized in Tab. 3.

Table 3. Legislative factors

M – Monitor	A – Analyze	P – Predict	I – Identify
Expert law: Act 254/2019 Coll., on experts, expert offices and expert institutes (ZnalZ)	The division of fields, sectors and the binding nature of specializations cause complications. Lack of clarity in this direction causes uncertainty and threats in terms of sanctions. The law requires expert institutes of the standard type to carry out research activities.	A "technical" amendment to the law will soon be prepared, to which the MoD can contribute in the comments procedure with its proposals for changes, thereby removing or better solving a number of ambiguities or problematic points from the law.	O02: Possibility to initiate a change to ZnalZ in favor of its greater functionality. O03: The requirement to carry out the institute's own research activity can expand the portfolio of its activities. T03: The lack of clarity of the industry and specializations can lead to risks in the performance of expert work
The legal position of the expert institute in relation to the Public Procurement Act (ZVZ) and potential conflict of interests	The ZVZ and European competition law foresee the awarding of public contracts, i.e. expert opinions, through public tenders.	Although competition law will probably be regulated in more detail in relation to in-house contracts, or in the field of vertical or horizontal cooperation, risks from the changing legal environment will persist.	T04: An incorrectly chosen legal form of an expert institute can make it impossible for MoD to commission the processing of expert opinions "directly" T05: The direct subordination of an expert institute can lead to suspicion of a conflict of interests, a threat to professional independence and thus a threat to the authority of the opinions being processed.
Expert standard	An expert	An expert	O04: COS is now

for METMS valuation	standard for the valuation of METMS does not yet exist, there are quite a lot of regulations regulating the given issue and they are mutually inconsistent.	standard in the form of the Czech Defense Standard (COS) for evaluating METMS is being prepared as part of the "Znalec" project	in preparation and could become a platform for covering the relevant regulations governing the issue of METMS valuation
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3.1.3 Economic factors

Following the sent-out questionnaires, the difficulty of processing individual required expert opinions was specified. Due to the great diversity, it is very difficult to determine the time required for their processing. E.g. in the field of real estate valuation, there is no standard or specification of the estimation of the time required to process the valuation of individual types of buildings. In the case of real estate valuation, the character of the real estate being valued plays an important role, as well as whether the expert is only required to set the decree price or to determine both prices, i.e. the decree price and the customary price.

In terms of initial investments, it is necessary to take into account the following costs:

- office space: renting or purchasing office space suitable for business, including workstations, meeting rooms and common areas;
- equipment and technology: investments in computers, software licenses, valuation tools, databases and other necessary technology to support your valuation activities;
- personnel: allocation of funds for the recruitment of qualified professionals such as appraisers, economists, market analysts, researchers and administrative staff (e.g. salaries, benefits and training costs, etc.);
- valuation sector research and its ongoing monitoring: conducting thorough market research, to understand the dynamics of the defense sector, market trends and potential demand for valuation services and expert-level expertise (e.g. expenditure on data acquisition, market reports and research tools, etc.);
- certifications and licenses: obtaining any required certifications, licenses or permits related to the valuation of assets in the defense sector, which may include professional development fees and costs;
- marketing and building the institute's reputation (its brand): allocating a budget for marketing and advertising activities, including website development, branding, content creation, social media campaigns and participation in industry events;
- legal and regulatory compliance: consulting with legal counsel to ensure compliance with applicable laws and regulations, which may include legal fees, registration costs and compliance-related expenses.
- infrastructure and security: investing in appropriate security measures, data protection systems and physical infrastructure to ensure the confidentiality and integrity of client information.
- insurance: obtaining the necessary insurance coverage, such as professional indemnity insurance, to mitigate potential risks associated with valuation activities;
- other expenses: e.g. accounting services, office supplies, utilities, telecommunications and other miscellaneous costs associated with the operation of the institute.

The analysis of the economic factors of the establishment of the institute is summarized in Tab. 4.

Table 4: Economic factors

M – Monitor	A – Analyze	P – Predict	I - Identify
Variability of expert activity costs	Reviews in the area of interest are highly variable in terms of the expertise required and the time required.	Due to the nature of the matter, variability in the scope and needs of individual expertise can be assumed in the future too.	T06: A potential expert institute will have relatively difficult to predict costs for expert work.

Costs of monitoring developments and trends in areas of potential acquisitions	They are not systematically monitored for the purposes of expert and expert activities, even though there are formally departments of MoD that are supposed to carry out this activity.	If there is no systemic change, a permanent state is assumed in the future	T07: If developments and trends in the area of anticipated acquisitions are not systematically monitored, there may not be enough data to process assessments. T08: Due to the lack of information on the state of knowledge, a technique is often ordered in the form of "research", which is more expensive than a typical solution. Components from different systems are often put together, the compatibility of which is problematic.
The costs of establishing and operating the institute	The establishment of the expert institute was indeed initiated by the Ministry of Defense on the basis of needs formulated by it, but without a clear idea of the impact on the budget, systemized jobs and other costs.	The conclusions of the solution of the POV Znalec project will define the expected scope and volume of activities of the expected expert institute and the associated necessary capacities of personnel, material and others, e.g. communication, organizational, etc.	T09: Operating expenses are often the subject of cuts in the preparation of the state budget and are rarely opposed by savings in investment funds and savings on the costs of possible legal disputes.
Savings in the acquisition cycle	the SAO, the procurement of equipment and the provision of service for the army are not effective. As a result, arming takes longer and becomes more expensive than planned	If there is no systemic change, a permanent state is assumed in the future	O05: Appropriate savings can be achieved by changing the system of preparation and monitoring of the acquisition process

3.1.4 Political factors

The analysis of the political factors of the establishment of the institute is summarized in Tab. 5.

Table 5: Political factors

M – Monitor	A – Analyze	P – Predict	I - Identify
Transparency of the acquisition process	Recently, there has been growing political pressure to increase the transparency of the acquisition process.	In general, the trend of increasing transparency can be assumed for the future as well	O06: The pressure to increase the transparency of the acquisition process may increase the need for both the amount and scope of expertise O07: The subject of the expert examination will not be only the purchase price, but a comprehensive assessment, incl. necessity, adequacy, life cycle costs.
Uncertain foreign policy situation	Recently, there has been a worsening of the international situation with implications for the strengthening of defense capabilities - an increase in defense resources and thus an increase in the number of acquisitions.	The trend is difficult to predict, but it can be assumed that the period of stability is not near.	O08: An increase in acquisition activities may imply an increased demand for expert opinions

3.1.5 Technological factors

The emergence of a potential expert institute will not be influenced by any specific or significant technological factors, i.e., no threats have been identified in this area, except economic ones (costs for the acquisition and operation of technologies), which are mentioned in the framework of economic factors in the relevant part of this analysis. However, the creation of an institute can support the acquisition and ongoing maintenance of know-how about the development and current trends of METMS, which is identified as an opportunity in Tab. 6.

Table 6: Technological factors

M – Monitor	A – Analyze	P – Predict	I – Identify
Monitoring technological development trends	Technological development trends are not yet systematically monitored	If there is no systemic change, a deviation from the current state cannot be assumed	O09: The establishment of an expert institute can create an expert base for the objectification of tender documentation of acquisitions in terms of the parameters requested by METMS

3.1.6 Ecological factors

The creation of a potential expert institute will not bring any significant ecological impacts, as it will be a normal workplace that will comply with valid ecological standards. From the point of view of the acquisition process, the establishment of the institute can contribute to the objectification of ecological requirements for acquisitions. However, these are part of the parameters as such and have already been identified as opportunities and threats in previous parts of this analysis.

3.2 Analysis of the industry environment

As stated in chapter 2, the analysis of the industry environment is carried out by applying Porter's five-factor model (the five forces model).

3.2.1 Power of Customers

It is assumed that the largest contracting "customer" of the expert institute will be MoD, with which the expert institute will have to be connected in some way so that expert opinions can be directly commissioned without the need to hold time-consuming selection procedures. This results in a relatively significant "negotiating" power of this customer, which can lead to a threat to the independence of the expert institute, both real and imagined (criticism by competitors, political opposition, media, etc.). This fact has been identified as a threat to be addressed in the proposal.

Other customers outside MoD are unlikely to have significant bargaining power and therefore do not represent any significant threat, so they are more of an opportunity for developing the competences of the expert institute.

The opportunity and threat coming from the power of customers are summarized in Tab. 7.

Table 7: Power of customers

M – Monitor	A – Analyze	P – Predict	I – Identify
Ministry of Defense	A key potential client, a source of funding, even potentially a functional superior.	Without systemic treatment, the operation of MoD can seriously threaten the independence and economy of the expert institute.	T10: A strong client can affect the independence and financial stability of an expert institute.
Other contractors	Other contractors do not have significant bargaining power for the expert institute, unless they are linked with the MoD.	No change is expected	O10: Work for other contractors can contribute to the financial stability of the expert institute

3.2.2 Power of Suppliers

It is not assumed that the expert institute should have any standard external suppliers in the form of legal entities. Its "suppliers" will be its employees or otherwise bound natural persons, whose reliability, expertise and performance will depend on the expertise of the expert institute. It can be assumed that their number will be limited. It follows that their power can be significant. This is related to the economic and social aspects already identified in the part of the analysis focused on the general environment.

The opportunity and threat coming from the power of suppliers are summarized in Tab. 8.

Table 8: Power of suppliers

M – Monitor	A – Analyze	P – Predict	I – Identify
Employees/cooperating natural persons	They are practically not on the labor market, they will have to be trained. Their workload for the institute's activities will be highly variable (if they only do assessments), there will be a problem with their retention and motivation. In MoD and dependent organizations and outside there are experts who would be able in short time to ensure the activities of the institute.	Without systematic treatment, the shortage or turnover of employees can seriously threaten or even completely paralyze the activity of the institute.	T 11: Unmotivated employees. O11: With the appropriate setting of the remuneration system and activities complementary to one's own expertise, it is possible to recruit and train suitable employees.

3.2.3 Threat of substitutes

A substitute in the case of an expert institute can be both experts standing outside the expert institute, but also the replacement of the need to "have an opinion" by other means of acquisitions than the form of public contracts, e.g. "G to G" type contracts (government - government). The opportunity and threat arising from the threat of substitutes are summarized in Tab. 9.

Table 9: The threat of substitutes

M – Monitor	A – Analyze	P – Predict	I – Identify
Apart from standing experts, expert offices and expert institutes	They are practically not in the required fields, they are not significant yet	The development depends on the attitude of MoD, whether and in what way it will allow access to the industry for commercial entities.	T12: Outside experts can be substitutes O12: There are practically no external experts yet.

3.2.4 Barriers to entry into the industry

There are basically two barriers to entering the industry: the acquisition of very specific knowledge, both professional and departmental organizational, and access to often classified information. However, these barriers are very relative, as overcoming them depends on the "attractiveness" of entering the industry, which is in the power of the Ministry of Defense in particular. Opportunities and threats arising from barriers to entry into the industry are summarized in Tab. 10.

Table 10: Barriers to entry into the industry

M – Monitor	A – Analyze	P – Predict	I – Identify
Information Sources	The acquisition process takes place separately and in a closed environment	No change is expected.	O13: As part of its activity, an expert institute can define the type and scope of information that should be provided during the acquisition process so that there is enough information to process the

Specific knowledge	They are often subject to secrecy	No change is expected.	assessment O14: Current MoD employees who should be considered for the institute often have appropriate security clearances.
Specialized education	In order to carry out expert work in a given field, it is necessary to complete additional education	No change is expected. A four-semester education is assumed.	O15: Necessity of specialized education
MoD attitude	With its unilateral decision, MoD can increase the attractiveness of the industry and thereby largely eliminate the influence of the identified barriers.	With the free setting of the codification of the institute, it is impossible to predict.	T13: MoD can increase the attractiveness of entry into the industry or organizationally adjust processes and thus make entry barriers low

3.2.5 Industry Rivalry

Rivalry in an industry that is not yet significantly occupied is not significant and is covered by the opportunity and threat identified in the threat analysis of substitutes.

3.3 Stakeholder analysis

The stakeholder analysis is summarized in Tab. 11.

3.4 Demand analysis

In accordance with the primary purpose, requests within the MoD were analyzed. To identify the real need for valuation, or the processing of expert opinions aimed at determining or verifying the price, under the conditions of MoD, were approached by selected entities dealing with the acquisition of property or services, most often in connection with the management of real estate infrastructure when determining the established, customary, or statutory price. Tab. 12 identifies weaknesses and strengths, opportunities and threats resulting from the demand analysis.

Table 11: Stakeholder analysis

Stakeholders	Relationship to the expert institute (substantive)	Power / Motivation	S, W, O, T
MoD	founder/ co-founder, key contractor	big / medium	O16: Founder can ensure the firm position of the institute and access to resources (informational and financial) T14: Founder may exert organizational, financial pressure, threaten independence T15: Simple lack of interest of the founder can threaten the very existence of the institute
University of Defense (UNOB)	possible source of experts	big / big	S01: There are a number of synergies between the activities of UNOB and the institute under consideration, which can prevent the building of duplicative capacities and demands for funding S02: A significant number of UNOB employees can acquire the expertise of an expert as part of their continuing education
ACR	customer, end user of acquisitions	big / big	S03: ACR has a large background for feedback on acquired property O17: The possibility

			of creating a feedback system for the evaluation and quality assessment process
Department of Justice	expertise manager	medium / medium	O18: Possibility of cooperation with SMEs to define expert sectors T16: Unforeseeable changes in expert law
Ministry of Foreign Affairs	manager of relations with foreign countries	medium / medium	O19: Linkage with the export/import of military equipment may occur through the MoH
Government agencies	industry support	small / small	O20: Government agencies can enable the institute to be involved in supporting the implementation of the government strategy
Arms industry and investors	customer / conflict of interest	big / medium	T17: The arms industry and investors can influence the independence of the institute through media or lobbying
Expert community	cooperation, competition	medium / medium	O21: The possibility of connecting and sharing capacities with experts in other areas O22: Possibility of expert training T18: Experts can lobby for weakening the institute's position for competitive reasons
International professional community	cooperation, competition	medium / small	O23: Possibility of exchanging experience with foreign workplaces T19: Possible impact of external influences from foreign non-independent experts disrupting the success of acquisition processes
Public	public control	medium / small	T20: The possibility of negative influence on the process of valuation and acquisitions by the media and the public
Media		big / small	
SAO	public control	medium / medium	O24: The possibility of converging opinions on the issue of valuation of acquired property
Parliament of the Czech Republic	public control	medium / medium	O25: Appropriate communication with the parliament can explain the issue of valuation and thereby reduce the pressure on the acquisition process
Employees of the institute	internal supplier	big / big	O26: Quality employees can gain a high reputation for the institute in a short period of time T21: Incorrectly selected, low-quality and unmotivated employees can threaten the functionality of the institute

Table 12: SWOT resulting from demand analysis

S04: There are departments in the MoD that routinely use expert opinions	W01: There are no processes set up in MoD for systematic use of expert opinions
O27: Fields of expert activity were identified, the need for which was not part of the content of the Znalec project and which expand the scope of the required activity of the expert institute	T22: The focus of expert opinions is very heterogeneous, the volume in one industry is relatively small

4 Research results – design part

In accordance with Chapter 2.2, the design part is processed using a modified 7 S method.

4.1 Strategy of the expert institute

The strategy of the institute is a key and rather extensive document, the scope of which greatly exceeds the possibilities of a scientific article. For this reason, the basic principles of the strategy of the intended expert institute are described here.

4.1.1 Founder of the expert institute

From the point of view of the assignment of the “Znalec” project, the expert institute should be a MoD expert institute. At the same time, threats were identified in the analytical part in relation to the threat to the independence of the institute and the associated threat to the credibility of the outputs of its work. These threats arise precisely from the MoD's possible interventions in the institute's activities, either directly or indirectly through financial, personnel, administrative or other similar instruments. At the same time, due to the possibility of direct input of assessments and other activities, a connection to MoD is necessary.

Considering the described limitations and conditions, a proposal for the establishment of an expert institute was discussed and evaluated positively by two public founders, namely the Czech Republic represented by the MoD and the Brno University of Technology (BUT), a public university. The details of the legal form and arrangement of relations between the institute and the founder will be the subject of another article.

4.1.2 Products and activities of the expert institute

In the analytical part, it was identified that the originally considered focus of the expert institute as an institution focused exclusively on the valuation of METMS is problematic, as a standard expert institute must carry out research activities. The analysis also shows that there is a demand in MoD for other types of expertise and expert activity. At the same time, a lack of systematic activity in the field of monitoring trends in the development of METMS was identified. Concretely, the analysis results in the following portfolio of activities (products) of the expert institute as shown in Tab. 13.

Table 13: Proposed portfolio of activities and products of the intended institute

Activity	Product	
1. expert activity in the field of METMS valuation	a) expert opinions	
2. expert activity in other fields and sectors, e.g. valuation of real estate, related services, current assets and services		
3. expert activity in the field of METMS		
4. systematic activity to monitor METMS development trends (so-called follow-up research)	b) supporting documents to initiate the acquisition process c) valuation standards in the area of interest d) standards for assessing METMS performance and effectiveness e) communication with the Ministry of Justice and the Ministry of Foreign Affairs about the specifics of METMS f) ordinary publication activity connected with research	
5. methodological activity in relation to the development of standards for obtaining information from potential suppliers during the acquisition process		
6. research activity in the fields of METMS and their evaluation		
7. educational activity		
8. organizational and administrative activity		g) preparation of connoisseurs and experts
		h) provision of teaching materials
	i) documents of an administrative nature	

4.1.3 Financing the activities of the expert institute

Following the proposed activities of the institute, see Tab. 13, multi-source financing is assumed, which is proposed in the following structure:

1. expert activity (activities 1 to 3): paid on a case-by-case basis according to the level of difficulty according to the hourly rate;
2. research activity (activities 4 to 6): institutional / targeted research support;
3. educational activity (activity 7): activity paid by the applicant or his employer;
4. administrative costs (activity 8): overhead costs, paid by the contribution of MoD.

4.2 Structure, method of management, system measures and location of the expert institute

The analyzes carried out show considerable heterogeneity in the field and volume of assessments processed in the past, as well as the assumption of this heterogeneity in the future. Even though MoD did not make a final decision on which of the activities the expert institute should provide, because in contrast to the assignment, broader needs for activities were identified in the analytical part, even so it is clear that it is practically impossible and at the same time inefficient to build a stable team of people in "stone" expert institute.

4.2.1 Structure

A suitable solution to the described problem appears to be the building of a matrix structure within MoD with an overlap outside it covered by a small coordination team. The matrix structure, known from many functioning multinational corporations, is to ensure the optimal use of all activities of the institute with the mime of newly created jobs, with the effective prevention of duplication of activities and costs.

The proposal envisages the use of MoD capacities, in particular the University of Defense, and other professionally suitably profiled entities such as the Military Research Institute or the Military Technical Institute etc. and one non-MoD component to ensure activities for which MoD does not have adequate competences, i.e. Institute of Forensic Engineering of BUT.

From the above and the “founder issue” explained in the paragraph 4.1.1, the proposal of the organizational structure of the expert institute as shown in Fig. 5 follows.

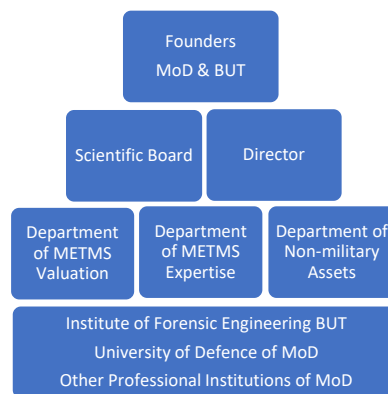


Figure 5. Structure of the proposed institute

Regarding the number of permanent staff at the expert institute (the small coordination team mentioned), the following positions should be involved:

- director;
- administrative worker and
- 3 guarantors of the activities of trade unions.

The numbers and competences of individual workers involved in the "matrix" are still being analyzed. In the event of an increase in the number of personnel, there could be an increase in the ability of so-called follow-up research for the purpose of collecting and verifying data, including the preparation of analytical documents for individual teams led by guarantors of the activities of professional unions.

4.2.2 Method of management

In the founding document, but also in other MoD documents, it is necessary to ensure that the founders cannot directly enter into the management of the institute and directly influence its activities, and that the results of the institute's activities are respected by the competent departments of MoD. This approach is captured in the following points:

1. appointment of the director of the expert institute on the basis of a selection procedure before the scientific council;
2. a defined term of office for the director (e.g. 5 years) with the possibility of serving a maximum of two consecutive terms of office;
3. the possibility of dismissing the director only if clearly defined and verifiable conditions are met;
4. establishment of the scientific council based on the appointment of the founders, establishment of the supervisory board based on the appointment of MoD;
5. setting up sustainable financing while respecting the portfolio of activities;
6. appointment of guarantors on behalf of the director after approval of his proposal by the scientific council;
7. the MoD will define the needs of search research at least once a year, see activity 4 in Tab. 13;
8. setting the principle of internal opposition of the results of analytical, methodical and research activities paid for from institutional funds;
9. the requirement to set up communication with other ministries, especially Ministry of Finance and Ministry of Health, government agencies such as CzechInvest and CzechTrade and other relevant workplaces, incl. foreign.

4.2.3 System measures

In order for the expert institute to become an integral part of MoD and its activity to be effective, the following systemic measures must be taken:

1. MoD will adjust the professional scope of the expert institute - in the analytical part, the fields and their sectors where the need was identified were identified; however, the final delimitation must be made by MoD;
2. MoD will ensure that the results of the analytical activity (search research) and methodological activity (activities 4 and 5 in Tab. 13) are respected in the acquisition process;
3. MoD will ensure that the submission of expert opinions is systematic - it will describe the cases when it is necessary to submit them and assign them to individual components;
4. securing the financing of the expert institute, see points 2 and 4 of paragraph 4.1.3.

4.2.4 Needs for placement of the expert institute

The proposal envisages five regular employees, i.e. five offices. Facilities, e.g. meeting room, day room, etc., can be shared.

4.3 Systems – Procedures, processes and routines

The systems will be set up after specifying the activities of the expert institute based on the founder's decision. An important process for ensuring the good functionality of the institute will be the process of communication with matrix-connected team members, both from MoD and from the Institute of Forensic Engineering BUT. Here, a system of internal grants thematically derived from the requirements of MoD, supplemented by a scientific council and continuously controlled by the guarantor of the MoD under whose purview the project will fall, is assumed.

4.4 Team, Style, Skills

It follows from the design of the organizational structure that a team of matrix-connected experts is expected, who will be coordinated by the core team of the expert institute. While the composition of the coordination team is clear, the composition of external collaborators will depend on the final decision of MoD on the required scope of activities of the expert institute.

The financing of the team of external collaborators is proposed through internal grants in order to ensure the opposition and the effectiveness of the funds spent. It is not recommended to pay with a lump sum contribution.

Part of the "Znalec" project is also a proposal for an educational system for experts in the field of METMS. All external collaborators are expected to go through this system.

4.5 Shared Values

The central goal of the expert institute is to provide independent expertise to MoD, to become a respected workplace with professional quality results. These goals create common values that are respected in the draft constitution.

5 Discussion and verification

The verification of the coherence of the analytical and design parts is carried out in accordance with the description in chapter 2 by comparing S, W, O, T identified in chapter 3 with the proposed procedures described in chapter 4. The summary of this verification is carried out in Tab. 14.

Table 14: Verification of the design part

Identified S, W, O, T, see Tabs. 2-12	Reflection in the design part
S01:	The proposal envisages the involvement of the University of Defense in the institute's activities, see paragraph 4.2.1 and Fig. 5
S02:	A part of the "Znalec" project is also the design of an educational system for experts in the field of METMS. All external collaborators will go through this system, see ch. 4.4
S03:	The proposal envisages close cooperation between the MoD and the expert institute, see e.g. paragraph 4.2.2
S04:	Justification of the need for the creation of an expert institute
W01:	These processes need to be set up, see paragraph 4.2.3, point 3
O01, O06:	The proposal envisages the identification of the branch of expertise and expert activity of the institute and the related capacity of experts, see paragraph 4.2.3, point 1
O02, O18, O19:	Tab. 13 in paragraph 4.1.2 assumes in activity e) the institute's communication with Ministries of Justice and Foreign Affairs about the specifics of METMS
O03:	Reflected in Tab. 13 in paragraph 4.1.2
O04:	It will be used in the processing of expert opinions and the training of experts
O05:	The entire design part and the proposed expansion of the portfolio of activities are aimed at this, see Tab. 13 in paragraph 4.1.2
O07, O09:	See the proposed expansion of the portfolio of activities, see Tab. 13 in paragraph 4.1.2
O08, O12:	Justification of the need for the creation of an expert institute
O10:	The expert institute will cooperate with all entities that will request its activities
O11:	Internal grants with verifiable outputs are expected for the benefit of participating collaborators, see chap. 4.4
O13:	See methodical activity of the institute in Tab. 13 paragraph 4.1.2
O14:	Easier start-up of the institute
O15, O22:	Design of educational system is a part of the "Znalec" project solution
O16:	The proposal for financing the institute is contained in the proposal part, see paragraph 4.2.3, point 4
O17:	Ensured by the establishment of the scientific council of the institute, whose members are appointed by the founder, see paragraph 4.2.2, point 4
O20:	The management of the expert institute must work with this opportunity, see paragraph 4.2.2, point 9
O21:	Secured by a matrix structure, see paragraph 4.2.1 and Fig. 5
O23, O25:	The management of the expert institute must work with this opportunity, see paragraph 4.2.2, point 9
O24:	Ensured by the establishment of the scientific council of the institute, whose members are appointed by the founder, see paragraph 4.2.2, point 4
O26:	It is related to shared values, see ch. 4.5
O27:	These fields will be consulted with MoD, which will define the activities of the expert institute, see paragraph 4.2.3, point 1
T01, T11:	The career and motivational system in the form of internal grants should ensure the stability of the team while maintaining the flexibility of change and addition
T02:	For this reason, a broader portfolio of activities than just expert activity is proposed, see Tab. 13 in paragraph 4.1.2
T03:	Tab. 13 in paragraph 4.1.2 assumes in activity e) the institute's communication with Ministry of Justice about the specifics of METMS

T04:	The legal form of an expert institute is also dealt with by "Znalec" project, the results of this research will be contained in a separate article
T05:	The introduction of two founders, a scientific council and other instruments should ensure maximum independence of the institute
T06:	For this reason, the proposal envisages multi-component fixed and variable financing, see paragraph 4.1.3
T07, T08:	The portfolio of activities listed in Tab. 13 in paragraph 4.1.2, point 4 includes systematic activity to monitor trends
T09, T14:	MoD must systematically ensure the funding of the institute, see paragraph 4.2.3, point 4
T10, T14:	The introduction of two founders, a scientific council and other instruments should ensure maximum independence of the institute
T12:	System of direct procurement eliminates it
T13, T15, T16:	These risks are outside the institution
T17-T20:	Systematic assurance of professional and financial independence can significantly mitigate this risk
T21:	The coordination team of the expert institute and the scientific council of the institute must mitigate the importance of this threat
T22:	This will be taken into account by the MoD when defining the institute's activities

6 Conclusion

In this article, the partial conclusions of the research carried out as part of the Expert project were presented in an abbreviated form with the aim of identifying the need for the establishment of an expert institute and at the same time determining the portfolio of its activities. From the analytical part, the need for the establishment of an expert institute in a scope significantly wider than the initial intention of the contracting authority is obvious.

The representatives of the contracting authority were continuously introduced to the research conclusions during the workshops that took place, and individual topics were discussed with them. The results of these discussions were incorporated into the analytical and design parts. It is obvious that a strategic decision by MoD is needed to put the results of the project into practice. Only after this can an implementation plan be drawn up, which establishes a specific description and timing of the individual implementation steps.

From the perspective of the research questions posed in the introduction of chapter 2, the research conclusions proved the following:

1. The creation of an expert institute is necessary to improve the transparency of the acquisition process, but in its wider scope as envisaged by the draft part, i.e. the expert institute should also be a methodical place for the acquisition process in relation to the selected required information, at the same time also a place where it is collected information on trends in the field of METMS, as well as a strong entity to communicate with Ministry of Justice, Ministry of Foreign Affairs, government agencies and other relevant institutions and workplaces;
2. In total, dozens of opportunities and threats, strengths and weaknesses of the institute were identified and reflected in the proposal,
3. The activities that the expert institute should perform were identified. These are then reflected in the design part.

Separate articles will present research results, i.e. results in the field of legal aspects of the institute's statute, the Czech defense standard for evaluating METMS and the system of training experts and experts for the purposes of the MoD.

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CONCEPT OF POL MOBILE LABORATORY FOR JP/F-34 AVIATION FUEL QUALITY VERIFICATION

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Abstract: The article deals with the concept of a new mobile fuel laboratory, which will enable the verification of the quality of JP/F-34 aviation fuel. Using external benchmarking, a multi-criteria analysis and subsequent comparison of analogous solutions at national and international level is performed. Focus is placed on fulfilling the requirements of the Army of the Czech Republic to verify the quality of JP/F-34 type aviation fuel in accordance with the relevant national and international technical standards, including the logistical support of the laboratory. The concept of a set of modular ISO 1C containers with corresponding laboratory equipment and estimation of capacities for practical use in the conditions of the Czech Army is proposed. It includes 3D visualization of the proposed mobile container laboratory - ISO 1C modular container set.

Keywords: POL laboratory, mobility, aviation fuel, quality, ISO 1C container.

1 Introduction

One of the key challenges of aviation logistics is the refueling of aviation fuel, and it is not only about quantitative requirements, but also about qualitative requirements, which are very strict in the case of aviation equipment. The article focuses mainly on the qualitative part, i.e. the verification of the quality of aviation fuel. If we proceed from the paraphrase of the quality (quality) from the nomenclature of ISO (International Organization for Standardization) 9000 series standards, the quality represents the fulfilment of the requirements of the Army of the Czech Republic (ACR), respectively the North Atlantic Treaty Organization (NATO), by a set of inherent product characteristics.(1) Product characteristics in this case mean normatively determined fuel parameters in accordance with technical standards (mainly VJS 1-3-L (2)).

From the perspective of the ACR practice, the quality of fuel, especially aviation fuel, has been dealt with within the Quality Control System since the inception of the Fuel and Lubricants Service in the 1950s.

From the point of view of Lessons Learned, the capabilities of the Czech Armed Forces were not adequately built due to the performance of tasks in multinational operations where there was an absolute dependence on the provision of aviation fuel by the armies of NATO member states, which, thanks to their technical equipment, can handle the acceptance from local suppliers according to the requirements of the relevant NATO standardization agreements - STANAG 3747 (3) and STANAG 1110 (4), therefore in adequate quality. Because of the assumption of further deployment in multinational task forces only, no building of own capabilities took place.

Gaining the capability to verify the quality of aviation fuel is necessary in order to gain independence from the logistic support of other states and possible logistic support of allied forces, and it is proposed to equip the Czech Armed Forces with a mobile container laboratory in accordance with the relevant standards (see above), analogous to the selected armies of NATO member states, e.g. the United States of America (Figure 1), Germany, Hungary or France.

The aim of the paper is to present the concept of a mobile PHM laboratory, including a comparison with currently used systems.



Figure 1. Petroleum Quality Analysis System – Enhanced, Author: Sgt. George W. Slaughter

2 Methods and data

The paper is mainly prepared using a variety of analytical methods. The current state of aviation fuel quality verification is critically analyzed and then the output is synthetically generalized in the form of a proposed solution using current technical and technological trends. It also includes a comparison of possible approaches using multi-criteria analysis (specifically the weighted sum method), which allowed the ordinal ranking of the considered options in descending order. It includes quantitative and qualitative criteria determined on the basis of their impact on the operation of the mobile PHM laboratory and user comfort

The data basis for the analyses and proposals were both the specific tactical and technical data of individual systems (variants) resulting from the implemented public contracts (criteria k1 to k5) and the results of a questionnaire survey among the professional POL community of the Czech Air Force bases with a 100% return rate. A separate part was the weights of individual criteria - their significance in the comparative analysis, which were also based on the questionnaire survey of the given group of experts. The identified preferences were consolidated into the resulting weight vector, using which the utility functions of interest were calculated within the framework of the multi-criteria evaluation of the variants.

3 Current state and system requirements

The Logistics Section of the Ministry of Defense of the Czech Republic, the Logistics Agency and the Air Force are currently gathering specific requirements from air bases and the Central POL Laboratory in Brno for the content and possible functionality of a mobile POL laboratory that could be placed in the ISO 1C container(s).

The need for such a laboratory is not only based on the requirements of the Czech Armed Forces, but also on its justified use in all places where helicopter technology is present. A mobile fuel container laboratory would greatly simplify the process of receiving and distributing fuel (in general), whether from the State Material Reserve Administration (SMRA) or from any civilian distribution network or pipeline. The containerized workplace with a mobile laboratory can be placed on any flat paved surface (max. with a slope of 5%) at an optimal distance from the deployment site (emergency), during the shutdown of the permanent laboratory or for the support of the airborne equipment of the Integrated Rescue System (IRS) of the Czech Republic during its long-term deployment in inaccessible terrain (e.g. forest fire, floods) and for the air rescue service.

Currently, the Air Force bases have the REO C-test/F-34 Portable Laboratory Kit (5), which is primarily designed to verify the basic quality parameters of F-34 fuel under field

conditions at the Type C test level and can also be used for other fuels such as Jet A-1 or F-54 diesel fuel.

The kit is placed in a stainless-steel travel box and all work with it is dependent on specially trained operators carrying out the relevant testing.

It is approved for use in dust-free, weatherproof locations with minimal humidity. Functionality shall be ensured when connected to electricity and in a location with the possibility of handling Class I and Class II combustibles. (6) The mobile laboratory shall serve not only for the actual performance of laboratory analyses and tests, but also as a storage facility for samples, sample tubes, a collection point for hazardous waste arising from the performance of analyses, an evaluation workplace and, last but not least, as a facility for the laboratory staff. The PHM laboratory is equipped with all the necessary sampling equipment in accordance with EN ISO 3170 Liquid petroleum products - Manual sampling. It is also equipped with the measuring and testing equipment necessary for the correct performance of the tests, including manuals supplied by the manufacturers of each piece of equipment. The equipment and its software used for testing, calibration and sampling shall achieve the required accuracy and comply with the specifications and test standards applicable to the tests. (6)

The POL laboratory shall have technological procedures for the safe handling, transport, storage and use of reference standards, materials and samples and procedures for scheduled maintenance of measuring equipment.

For independent operation of the fuel management, the laboratory must encompass the scope of the B-1 and C-1 type tests (7), see. Table 1.

Table 1. Tests required for JP/F-34 aviation fuels (7)

Tested parameters	Type of test	
	B-1	C-1
Appearance and impurity content (visually)	X	X
Color (visually)	X	X
Density at +15 °C	X	X
Distillation test	X	X
Corrosion on copper	X	
Crystallization point	X	
Content of resinous substances	X	
Pressure according to Reid	X	
Flash point in a closed crucible	X (only F-40)	
Reaction with water	X	X
Content of mechanical impurities (gravimetrically)		X
Freezing additive content	X (only F-34, F-40, F-44)	X (only F-34, F-40, F-44)
Electrical conductivity	X (not F-44)	X (not F-44)

If the prescribed instrumentation is expanded to include an open cup flash point test (Cleveland) and kinematic viscosity, the mobile laboratory will increase its utility value and "upgrade" to a fully autonomous laboratory also in terms of verifying the quality of aviation engine oil and the purity of aviation hydraulic fluid.

4 Mobile POL laboratory concept

The design of the instrumentation of the mobile fuel laboratory for the F-34 type aviation kerosene is based on the American Society for Testing and Materials (ASTM) standards (8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22) which are binding for the ACR by way of the approved Military Quality Specifications. The standard addresses the minimum technical equipment to perform the various required tests (listed in Table 1 above) for the analysis of aviation fuel with respect to its mobile use outside the permanent laboratory.

Considering the experience with currently used systems, which are used cross-sectionally in various armies (e.g. Hungary, the United States, Poland), the requirements for a mobile laboratory can be met by two approaches - variants. Both variants are standardly used by the Army for similar applications. Historically, the more widespread is the construction of a tent variant in the form of e.g. the inflatable tent DIT/044CZ, which is currently replaced in various applications by a modular solution using standardized ISO series 1 containers. (23)

For operational and ergonomic reasons, it is more suitable to place the equipment of all workplaces in a set of two interconnected, demountable containers, where in one of them it is planned to place technological equipment, including water distribution, gas (from a pressure cylinder), collection containers and a spare source of electricity. In the second one, it is planned to carry out tests less demanding on instrumentation: electrical conductivity, density, fuel-water reaction, mechanical impurities content by colorimetric method, as well as evaluation and recording of results, storage of armament and equipment. The arrangement of handling and storage spaces within the container set offers variability in the placement of measuring instruments.

The material solution of the handling surfaces is made of stainless steel, which is resistant to the chemical effects of petroleum substances and is easy to maintain.

An integrated part of the container set is an electric power plant ensuring the independence of the mobile laboratory from the electricity supply. Solar panels can also provide an additional, noise-free source. A fume hood for explosive environments and a water spout are installed at the same time.

5 Multi-criteria evaluation of variants

For the comparison of the variants, 12 criteria were set, where the values of the first 5 quantitative criteria are based on the procurement of analogous material. The values of the remaining 7 qualitative criteria were determined by a questionnaire survey focusing on user comfort during testing, provision of facilities, sample handling, maintenance and the possibility of arranging the necessary equipment for the PHM laboratory. Respondents were given a choice of three options for each question based on their preferences: A set of two ISO 1C containers, an inflatable tent, or no preferred option. The results for each question can be seen in Table 2. It is clear that the expert community clearly chose option B, the combination of two ISO 1C containers. For each criterion, this option was chosen by between 65% and 85% of all respondents.

Table 2. The values of the criteria of each of the compared variants

Criterion	Option A - Tent DIT/044CZ	Option B - Container ISO 1C	Type of criterion
Initial economic cost (CZK)	1 572 000	1 662 540	Minimizing
Dimension in unfolded state (m ²)	49,83	29,54	Minimizing
Deployment time (min)	120	30	Minimizing
Minimum use	-40	-32	Minimizing

temperature (°C)			
Maximum use temperature (°C)	55	50	Maximizing
C1 examination performance (%)	16,67	83,33	Maximizing
B1 examination performance (%)	16,67	83,33	Maximizing
Record-keeping, evaluation (%)	16,67	83,33	Maximizing
Background for time out of service (%)	33,33	66,67	Maximizing
Storage and handling of samples (%)	16,67	83,33	Maximizing
Cleanliness and sterility maintenance (%)	16,67	83,33	Maximizing
Workplace layout variability (%)	28,57	71,43	Maximizing

From an economic point of view, mobile testing of POL using an inflatable tent (model option A) appears to be more advantageous, assuming the same laboratory equipment is placed in the insulated transport boxes, where the costs can be considered identical. It can be assumed that the option using two ISO containers (model option B) will be more expensive (depending on the specific public contract and the tendered price). The use of standardised furniture commonly used in the Czech Armed Forces can be assumed for variant A. The equipment for variant B is assumed to be 'tailor-made', which offers greater personalisation and adaptation to the comfort requirements when working with measuring instruments at a higher cost.

Using multi-criteria analysis, the two variants (A and B) are compared to ordinally determine the value of a utility function that identifies the more appropriate variant in relation to the criteria values and weight vector. In general, the multi-criteria variant evaluation matrix can be described as follows:

A list of possible variants (1, 2 to n) is given:

$$A = \{a_1, a_2, \dots, a_n\}$$

Then a list of evaluation criteria (1, 2 to k):

$$Y = (y_{ij})$$

According to these criteria, each variant a_i , $i = 1, 2, \dots, n$ is described by a vector of criterion values $(y_{i1}, y_{i2}, \dots, y_{ik})$. This results in a mathematical model of the multi-criteria variant evaluation problem expressed in the form of a criterion matrix:

$$Y = (y_{ij})$$

The criterion matrix can generally be written as follows:

$$Y = \begin{pmatrix} y_{11} & y_{12} & \dots & y_{1k} \\ y_{21} & y_{22} & & y_{2k} \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ y_{n1} & y_{n2} & \dots & y_{nk} \end{pmatrix},$$

After fitting the obtained values, the matrix is received:

$$Y = \begin{pmatrix} 83,33 & 83,33 & 83,33 & 66,67 & 83,33 & 83,33 & 71,42 & 1662540 & 29,54 & 0,5 & -32 & 50 \\ 16,67 & 16,67 & 16,67 & 33,33 & 16,67 & 16,67 & 28,57 & 1572000 & 49,83 & 2 & -40 & 55 \end{pmatrix}$$

According to Table 1, 8 of the 12 criteria are maximisation criteria. The first 4 criteria in Table 1 need to be converted to maximisation criteria. This is done using the following formula:

$$y_{ij} = \max(y_{ij}) - y_{ij}, i= 1,2, \dots, p, j = 1, 2, \dots, k$$

The corresponding matrix is obtained:

$$Y = \begin{pmatrix} 83,33 & 83,33 & 83,33 & 66,67 & 83,33 & 83,33 & 71,42 & 0 & 29,54 & 1,5 & -32 & 50 \\ 16,67 & 16,67 & 16,67 & 33,33 & 16,67 & 16,67 & 28,57 & 90540 & 49,83 & 0 & -40 & 55 \end{pmatrix}$$

Since these are different quantities, measured in different units, it is necessary to normalize the matrix according to the following formula:

$$r_{ij} = \frac{y_{ij}-d_j}{h_j-d_j}, i= 1,2, \dots, p, j = 1, 2, \dots, k, \text{ where } d_j = \min(y_{ij}) \text{ and } h_j = \max(y_{ij}).$$

After fitting, a normalized matrix is obtained where all criteria are measured in the same (dimensionless) unit:

$$Y = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \end{pmatrix}$$

The questionnaire survey included the weighting of each criterion as shown in Table 3. The surveyed professional community was provided with a rating scale from 1 to 5, where the number 1 indicates the least and the number 5 the greatest importance of the respective criterion. The middle column shows the average value of the responses received and the right column shows the resulting weight of the criterion, which was calculated according to the following formula:

$$V_i = \frac{p_i}{\sum_{i=1}^k p_i}$$

Table 3. Weighting vector for each criterion

Criterion	Average value	Weight
C1 examination performance	4,66	0,123
B1 examination performance	4,66	0,123
Record-keeping, evaluation	3,83	0,101
Background for time out of service	3,66	0,096
Storage and handling of samples	4,33	0,114
Cleanliness and sterility maintenance	4	0,105
Workplace layout variability	3,66	0,096
Initial economic cost	1,16	0,029
Dimension in unfolded state	3,16	0,083
Deployment time	2,16	0,057
Minimum use temperature	1,33	0,035
Maximum use temperature	1,33	0,035

The preferred option is the one that maximizes the sum of the products of the criteria weights and the corresponding values from the normalized criterion matrix:

$$\sum_{j=1}^k v_j r_j \rightarrow \max$$

After assigning specific values, the utility function of each of the considered options is calculated, and due to the maximization approach, option B can be considered more appropriate because it achieved a higher value of the utility function (Table 4).

Vari ant	$\sum_{j=1}^{13} v_j r_j \rightarrow \max$	Rank ing
A	$0,123*0+0,123*0+0,101*0+0,096*0+0,114*0+0,105*0+0,096*0+0,029*1+0,083*1+0,057*0+0,035*1+0,035*1 = 0,185$	2.
B	$0,123*1+0,123*1+0,101*1+0,096*1+0,114*1+0,105*1+0,096*1+0,029*0+0,083*0+0,057*1+0,035*0+0,035*0 = 0,815$	1.

A multi-criteria evaluation of the options revealed a clear dominance of option B, i.e. 2 connected ISO containers, which is more than four times better than option A, i.e. the inflatable tent. The results are mainly based on a questionnaire survey that interprets the opinion of the professional community of the airport POL service of the ACR.

6 Mobile laboratory design

Due to the relatively clear result, where option B can be declared as clearly preferred, a visualisation of the possible layout of the mobile laboratory for aviation POL was developed. The visualisation is shown in Figures 2 and 3.

In developing the graphical design, consideration was given to the requirements of the ASTM standards described above, the requirements for sufficient space to accommodate the contemplated instrumentation, equipment and instrumentation, and the performance of administrative work. At the same time, material and colour design was considered to allow easy maintenance, high durability and user comfort.

The specific layout of the instruments and storage areas will be the subject of further research to find the optimum solution in terms of minimising time and distances between sites during standard POL analysis.

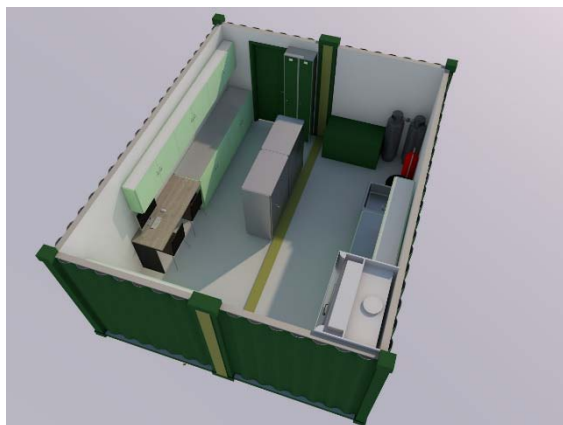


Figure 2. Mobile container laboratory design rear view

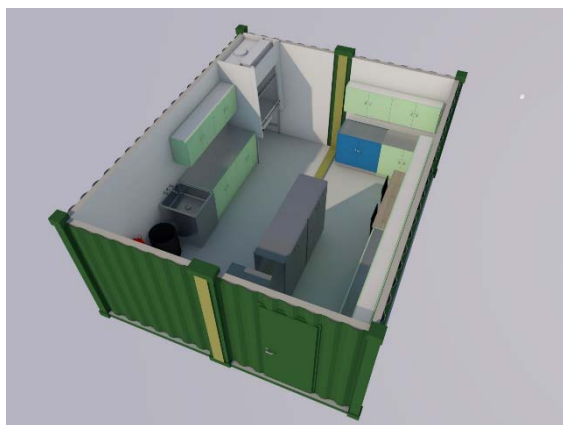


Figure 3. Mobile container laboratory design front view

7 Discussion

The presented concept of a mobile fuel laboratory for verification of JP/F-34 type aviation fuel can be considered as highly effective not only for normal peacetime operation in the conditions of the Czech Armed Forces, but especially for operational purposes, when the capability created in this way can be offered to the armies of NATO member states.

A presumption is to use the laboratory not only to verify Just-in-Case fuel from its own sources or from allies (either directly

from the respective militaries or from Host Nation Support (HNS) sources), but also from local (unverified) sources, which would enable efficient use of fuel in the Joint Operation Area (JOA)

From the deployability point of view, the use of the ISO 1C container-based transport system is very suitable, which also allows a certain degree of modularity in the future in relation to new technologies and air force requirements.

8 Conclusion

Modern conflicts generally point to the rapid development of drones and other unmanned vehicles, which will also increase the logistical requirements for both aviation fuel and spare parts. New technologies are then linked to the increased sensitivity of engines and parts of aviation equipment to poor quality fuel. The presented preventive approach offers a solution and is based on the basic principle that prevention costs many times less than dealing with damage to government property following the use of poor-quality fuel.

The subject of further research will be the specific layout of the laboratory using the latest technologies in order to meet the requirements of the relevant standards. This will include defining specific capabilities at national but also international level to contribute to the NATO "pool" of capabilities to verify the quality of aviation fuel. An extension of the approach discussed will be a risk analysis in the context of the implementation of the container laboratory in multinational operations, including the inclusion of control activities for locally sourced fuels. Local sources may not only be the provider of low-quality fuel, but may also be purposefully degraded by an adversary or diversionary group. For example, water alone is sufficient to contaminate fuel, which is a potentially very effective, inexpensive, and simple way to disrupt the entire Air Force logistics chain.

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