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A	SOCIAL SCIENCES
B	PHYSICS AND MATHEMATICS
C	CHEMISTRY
D	EARTH SCIENCE
E	BIOLOGICAL SCIENCES
F	MEDICAL SCIENCES
G	AGRICULTURE
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A SOCIAL SCIENCES

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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

UTILIZING INTERNATIONAL INVESTMENT LAW FOR ECONOMIC GROWTH AND SOCIAL PROSPERITY IN DEVELOPING COUNTRIES

^aABDULELAH ALSAHLI

*College of Law and Judicial Studies, University of Jeddah
PO Box: 34, Dahaban, 21959, Jeddah, Saudi Arabia
email: ^aaalshle@uj.edu.sa*

Abstract: The article aims at defining the underlining meaning of International Investment Law and seek to evaluate its characteristics. Economic growth and social prosperity are fundamental necessities in developing and least developed countries. The Effective application of International Investment Laws requires integrating fundamental principles and regulatory reforms related to foreign investments by host countries. The article analyses the required effective means of utilizing international investment law and promoting foreign direct investments in developing countries. Furthermore, the discussion will outline the necessary investment environment required in developing countries to realize the benefits of foreign direct investments and conform to international investment practices.

Keywords: IIL, FDI, International investment law, foreign direct investment, dispute resolution methods

1 Introduction

Globalization is a process that impacted today's politics, cultures and economic life everywhere. The process facilitated the growth of trade activities internationally and increased domestic integration into global economic systems [27]. Subsequently, International Investment Law (IIL) evolved over the years to provide structure and mechanisms that promotes international harmony between countries. IIL is pivotal to international investment relations and its security. Therefore, many international institutions established and conventions promulgated to specifically focus on international investment relations. National regulations that conform with IILs benefits from attracting foreign direct investments.

Investment cooperation in light of the international regulatory framework is of considerable advantage to developing nation. The utilization and adoption of its mechanisms yields to prospective economic advantages and domestic advances. Such advances include, and not limited to, education, technology, and societal benefits.

Developed nations promotes an effective and efficient practices that harnesses the use of IIL. Bilateral, regional, and multilateral treaties are essential tools to attract foreign investors in developing countries. Foreign direct investment became an important objective for governments to ensure sustainable growth and promote national developments.

The article aims at defining the fundamental objectives and mechanisms of IIL that can be of benefit to developing countries and least developed economies. Furthermore, the article will outline and discuss the available tools for developing countries to achieve national economic growth across multiple sectors and social prosperity. Finally, the article will discuss the required characteristics of investment environment in developing countries to promote and attract foreign direct investments.

2 Methodology

The article involves specific research methods. A logical, systematic, and critically analytical approach adopted to answer the research questions. This includes identifying regulations structure, history, and its synchronization internationally. The adopted empirical legal research methodology assists in analyzing the available materials concerned with the subject matter. Not only focusing on laws or regulations but also considers the functionality of institutions and organizations in the legal field [14]. Further, the method helps in answering evaluative questions and addresses legal agreements implementation and its difficulties. The normative analyses methodology evaluates the relevant data and analyze its practicality and functionality.

3 Results and Discussion

3.1 Meaning of International Investment Law

The meaning of International Investment law (IIL) can be established by identifying the core aspects surrounding its nature. Specifically, it deals with the regulations covering activities internationally and the settlement of foreign investments. IILs are generally considered as a field of public international law, yet others categorized it under the field of transnational contract law that is governed by domestic legislations and International Law rules [6]. Nonetheless, the application of IIL requires the practicality of three specific features within domestic application. Those features consist of establishing a decentralized approach, organic emergence and a contested yet stable policy [23].

The application of IIL relates to the first outlined feature which refers to countries who became signatory to decentralized international treaties whether bilateral or multilateral [23]. This is the opposite of centralized international treaties and organizations, such as the World Trade organization (WTO) or the United Nations (UN). Instead, decentralized international treaties includes agreements between specific states such as North American Free Trade Agreement (NAFTAs) and other Free Trade Agreements (FTAs) between nations. The scope of IIL extends further and accommodate international dispute resolution agreements within conventions and designated institutions, such as the New York convention on the enforcement of foreign arbitral awards and the International Centre for Settlement of Investment Disputes (ICSID). The decentralized approach assists in harmonizing national practices with international practices [4]. Thus, achieving a higher level of conformity to international standards. This is particularly important for developing countries, as it assists in developing the national regulatory framework to accommodate international perspectives and promote investments.

The second features of IIL are its organic emergence. The essence of IIL was developed through the evolution of international relations and states mutual benefits. Developing countries or countries moving on from an economic crisis promulgate IILs and its decentralized approach due to an emergence of organic specific state reasons. The third feature of IIL is the existence of a domestically contested yet stable policy [24]. To elaborate, international investors may consider investing in a specific country is of high risk since the only method of dispute resolution is national litigation. Therefore, it raises the difficulty of contesting decisions. Arbitration as an alternative dispute method to litigation is considered the most preferred method of dispute resolution for foreign investors. Countries that convey to the New York convention and have a robust internationally practiced Arbitration Laws, such as the UNCITRAL Arbitration law and rules, attracts foreign investors. As a result, states applying IIL adopts a dynamic policy that protect investors.

3.2 Types of investment treaties

IILs evolved over the past 50 years and encompasses several types of international trade agreements. More specifically, states may agree to bilateral, regional, or multilateral investment treaties. Bilateral trade agreements are typically conducted between two countries to promote the investment opportunities between them [10]. Such agreement may focus on specific sectors, such as energy or technology, others accommodate multilateral sectors. An example of a bilateral agreement is the United States (US) and Vietnam bilateral trade agreement signed in 2000. The agreement provided Vietnam with higher economic growth and extended its favored nation status over the years [16].

Regional trade agreements cover countries within specific geographic areas. Such agreements assist in the free movement of goods and services between the signatory states [32]. An example of such agreement is the Asia-Pacific Economic Cooperation (APEC). The APEC 1989 agreements aim to achieve regional prosperity and accelerate economic integration. Within such agreements, countries in specific regional agreements, particularly developing, benefit from integrating a synchronized regulatory framework to facilitate faster and easier movement of goods and advantageous investment climate.

Multilateral trade agreements are those where three or more countries are signatory to a trade agreement. The General Agreement on Tariffs and Trade (GATT) 1948 is an important and influential multilateral trade agreement. GATT was responsible for many years in reducing trade tariffs or quotas between signatory members and helped promote the benefit of international cooperation in trade. Nonetheless, GATT was replaced by the WTO in 1995 [30]. The WTO is considered the main international organization concerned with international trade rules. Its main purpose is to ensure the practicality of free and smooth movement of trade internationally amongst 164 members [33]. Furthermore, the WTO is responsible for enforcing number of trade agreements such as the 1996 Information Technology Agreement (ITA) and the 1994 Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). The evolution of Bilateral, regional, and multilateral investment treaties over the years flourished its use internationally. Such investment agreements or treaties are valuable tools for developing countries to achieve economic growth.

3.3 Fundamental principles of IIL

Effective application of IILs requires integrating fundamental principles related to foreign investments by host countries. The principles may vary or change depending on the investment agreements. Nevertheless, there are concepts which are approved and practiced internationally and expected as an essential requirement. Fair and equitable treatment is an important principle of IIL. The principle is a cornerstone in many international investment treaties [18]. For instance, Article 1105(1) of the NAFTA agreement provides that “*Each Party shall accord to investments of investors of another Party treatment in accordance with international law, including fair and equitable treatment and full protection and security*”. Furthermore, the UN code of conduct on Transnational Corporations emphasizes the obligation of governments to provide fair and equitable treatments in accordance with the laws and regulations practiced by the government and in consistency with International Law [18].

As stated above, the principle is adopted in most international investment treaties. Nevertheless, fair and equitable treatment principle is considered broad under close evaluation. The extent of a fair and equitable treatment will depend mainly on the circumstances of the case at hand and the country adopted regulations. The interpretation varies from a jurisdiction to another. For instance, France considers the application of international public policy in disputes that includes foreign parties [3]. However, other jurisdictions that apply sharia principles will not apply international public policy if a breach of sharia principles occurred. Number of disputes required the interpretation of the fair and equitable treatment principle, such as in *Azurix v Argentina (2006)* and *Occidental v Ecuador (2004)*. The central argument typically evolves around questions regarding the standards of application. Courts and tribunals will consider the minimum standards of fair and equitable treatment and whether breaches of international law occurred by the host state [7]. Nonetheless, the treaty is the primary source of interpretation with regards to the principles, as it dictates the level of protection and stability provided by the host country to foreign investors.

Cooperation is another fundamental principle under IILs practices. The principle involves international cooperation in

relation to the adopted policies [31]. Theoretically, this includes unifying the policies related to international investments. The cooperative efforts led by developed countries aim at reducing the issues associated with international investments and benefits developing countries in promoting foreign direct investments. Host countries adopting clear policies that conform to international practices attract FDI and promote sustainable development.

Unique policies that are influenced by domestic regulations and hostile to international practices are not attractive to foreign investors. Such an approach by a host state affects promoting FDI due to the lack of certainty and protection on investment in the host country. The principle of cooperation assists host countries to adopt incentive policies to attract foreign direct investments. This will create a non-discriminatory and predictable regulatory environment with a stable macroeconomic and an engagement to international trade [31].

States that are aiming to promote international investments must set forth a mechanism of foreign investment protection. The principle of protection complements the principle of fair and equitable treatment and the principle of cooperation. Host countries providing regulatory protection for foreign investment encourage foreign investors. Investment protection policies convey a level of stability and clarity [5]. Means and levels of protection vary depending on the nature of the investments. Nonetheless, the level of protection provided for foreign investors should amount to the minimum standards adhered to internationally. This includes adopting policies that ensure fair and equitable treatment, foreign parties contractual freedom and access to dispute resolution methods [17]. Developing countries that adopt clear protection policies for foreign investment will realize the benefits of FDI and a sustainable development. This requires enacting special regulatory framework and adopting internationally recognized policies. Most importantly there must be limited governmental interference.

Dolzer and Schreuer considers that the primary ratio of protection and security lays on host states obligation to protect investors from physical violence, including premises invasion, and guarantee against infringements on the foreign investors rights with accordance to the host state laws and regulations [7]. Protection and security clauses are typically part of international investment treaties and expected to be adequately granted by the host country. In the *Wena Hotels v Egypt case (2000)* the authorized tribunal found Egypt liable for not acting to protect the investors adequately prior and after the invasion of state employees to the premises. Nonetheless, the meaning of state protection is not limited to physical protection. In the *Azurix v Argentina (2006)* the tribunal found that a provision of full protection and security extends to beyond physical security. This may include the protection of tangible and intangible assets as found in *Siemens v Argentina (2007)* [26].

The list of principles of IILs are not limited to mentioned above. Host states must have a general recognition to investments for sustainable development. This is represented by the coherent drafting of policies and its implementation by governing and public institution. The drafted policies that outlines the policies are ought to be regularly reviewed to ensure the existence effective, relevant and dynamic policies in the host state.

3.4 Why Foreign direct investment

Foreign directed investment (FDI) is an essential element for globalization. FDI promotes international economic integration through the creation of long-lasting and stable concoctions between national economies [19]. In practice, FDI represents the lasting interest by foreign direct investors to invest in other international economies. This implies the establishment of a long-term agreement between foreign investors and countries with a high degree of management by the investors [19]. Domestic economies can benefit greatly from FDI yet requires the application of the right policy environment that conform to

international practices. Such benefits include infrastructure developments, transfer of technology and economic growth.

Forms of FDI are not limited to governments only. Direct investors can be governments, private individuals incorporated entities and other forms [8]. Based on the FDI definition an entity or a private individual is considered a foreign direct investor if the investment is conducted in a country other than the country of residence of the investors [8].

Undoubtedly, FDI is a main goal and core for developing national economic policies. It is impactful in a direct and indirect ways to the host country [15]. Due to FDI vast benefits most nations adopt a liberal and acceptant view of such investments, whilst limited countries adopt severe restrictions towards foreign investors. Globalization has assisted in the development of FDI and its acceptance [25]. The level of current technology and awareness promoted its acceptance amongst nations and its benefits for developing economies.

Many types of FDI exist and evolved over the years. Greenfield investment is welcomed by host countries due to its nature and advantages [39]. This is when companies decide to expand its investment or build a new production facility in the host country, such as car manufacturers. This type of investment is positively greeted by host countries because it lowers the rate of unemployment, provides the required technology, and connects the host nation to international markets [9]. Other types of FDI include mergers and acquisition or joint ventures.

The importance of FDI lies in facilitating capital growth and economic transformation within developing countries and is considered an essential instrument of external finance. However, social development is an additional benefit of FDI. This is particularly of importance to developing countries. For example, foreign companies operating in host countries may positively influence the economy via its adopted corporate social responsibility policy. Such policies encourage a better practice within the company and public [11]. Furthermore, one can argue that countries' economic growth could lead to social stability whilst providing citizens with a higher standard of life.

Okara questioned FDI's link with political stability within developing countries [21]. The findings showed that FDI in developing countries encourages and promotes political stability. The vast benefits of FDI have been realized over the years. Developing countries have become active in attracting foreign investors to achieve the above-discussed benefits. More than ever the United Nations Conference on Trade and Development (UNCTAD) encompasses 195 countries [34]. One of the UNCTAD main objectives is to support developing nations to realize the advantages of a globalized economy with an effective and fair approach.

FDI in the host state may encourage social progress with a positive impact in many elements. This includes the positive impact within education, infrastructure, technology as well as personal and political progress. A study conducted by Kolstad and Tondel analyzed the relationship between social development and foreign direct investment in developing countries [40]. It was found that FDI encourages political stability and reduces domestic conflicts. The relationship between FDI and social progress is mostly positive. Besides the objective of economic growth, developing countries must consider the positive social impact of FDI and its contribution to the society.

3.5 Settling FDI disputes

International investment agreements have significantly increased over the years. Bilateral treaties have increased from 72 treaties in 1969 to more than 2500 treaties by 2021 [20]. The increasing number of international investments and agreements will subsequently increase the number of disputes that will arise. Therefore, countries hoping for FDI to participate domestically

must ensure a practical and clear dispute resolution method set in place.

Litigation is the traditional method of dispute resolution. It is undoubtedly most desired and preferred by the host state. Nonetheless, foreign investors have grown wary from submitting their disputes with host countries to litigation. Investors claim that litigation in host states courts lack impartiality since they failed in providing sufficient guarantees of protection for the investors [17]. For investors, litigation can be time-consuming, very expensive and complex in the host state.

Alternative dispute resolution methods have evolved to support and encourage international investments. Such methods include Arbitration, Mediation, and Conciliation. Nonetheless, arbitration is considered the most preferred dispute resolution method by foreign investors [37]. This can take the form of an Ad hoc arbitration or an institutional arbitration. Ad Hoc arbitration provides the parties to the dispute with flexibility in selecting the desired arbitration conditions [38]. Such conditions include the applicable law, governing law, seat of arbitration, language and place of arbitration. An Ad hoc arbitration provision in trade agreements between the host state and foreign investors can be exercised if the dispute has arisen. Therefore, the parties must submit to arbitration as an alternative dispute method to litigation.

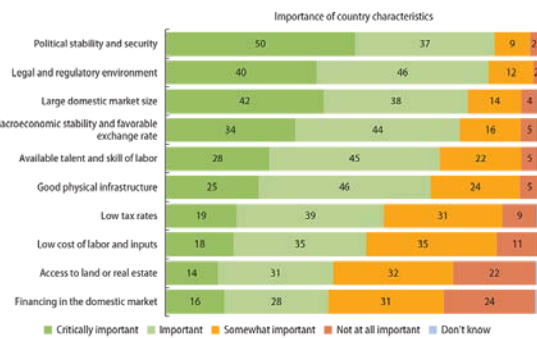
Institutional arbitration provides further protection for FDI, due to its clarity and certainty. The parties in an ad hoc arbitration must identify all the dispute elements and conditions prior to starting the procedure. On the other hand, institutional arbitration can provide further guarantees than an ad hoc arbitration to expedite the process. The International Centre for Settlement of Investment Disputes (ICSID) was established in 1966 and considered as the leading international arbitration institution for international investments. Currently, there are 163 signatory and contracting states to the ICSID. Its main purpose is to protect foreign investments by providing and facilitating investment dispute settlement mechanisms [28]. Furthermore, it aims at promoting investment in developing countries by increasing foreign investors' confidence in protecting their investment via state-investor arbitration.

Settling states and foreign investors' disputes at the ICSID via arbitration will result in a binding final award. According to Article 53 of the ICSID convention "(1) The award shall be binding on the parties and shall not be subject to any appeal or to any other remedy except those provided for in this Convention. Each party shall abide by and comply with the terms of the award except to the extent that enforcement shall have been stayed pursuant to the relevant provisions of this Convention". Alternatively, host states and foreign investors can agree to submit the dispute to other arbitration institutions, such as the London Court of Arbitration (LCIA) or Singapore International Arbitration Centre (SIAC). Furthermore, the 1958 New York Convention is adhered to by more than 160 countries. The convention focuses on the recognition and enforcement of foreign arbitral awards [12]. The New York Convention provides international parties with defined mechanisms for the enforcement of foreign arbitral awards. Foreign arbitral awards are typically enforced by signatory states' domestic courts if no breaches to Article V of the convention occurred.

Arbitration is considered a valuable method of dispute resolution in international investment relations. Many countries have reformed their Arbitration Laws to conform to international arbitration standards and attract foreign investors. For instance, Saudi Arabia has reformed its Arbitration Law in 2012 which is based on the UNCITRAL Model Law on International Commercial Arbitration, to reach a higher level of conformity and attract foreign investors. The old Saudi arbitration law was deemed negative to international arbitration and impractical by foreign investors that resulted in loss of investment opportunities [1]. Host states are urged to develop their Arbitration Laws in accordance with international practices to attract FDI.

3.6 Developing an attractive investment environment

Host states investment environment characteristics are of significance and thoroughly analyzed by foreign investors. FDIs are a long-term and profitable investments, countries aiming to attract FDIs will promote investment incentives that focuses on foreign firms [2]. Such incentives include favorable fiscal policies and reduced corporate tax towards foreign investors, the sustainability of such approach has been questioned. Blomstrom argues that incentives focusing exclusively on foreign investors is not a recommended strategy as it may discourage local investors [2]. Nonetheless, developing countries are required to focus on and enhance specific characteristics in order to utilize and realize the benefits of FDIs.

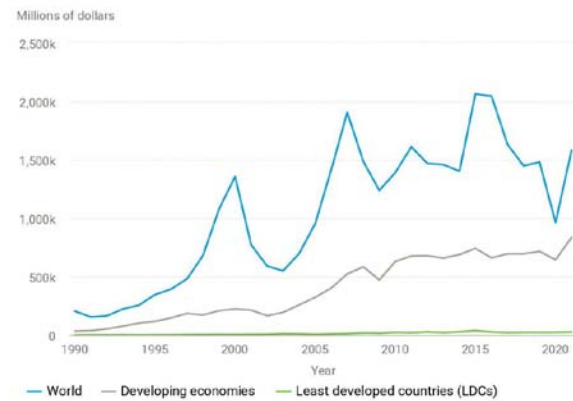


Source: [36]

The above graph indicates the main important characteristics of developing countries analyzed by foreign investors prior to investing. There are number of critically important matters which determines whether the host state is attractive for FDIs or certain developments are required. Political stability and security in the host state is a primary concern for foreign investors. Okara argues that investors favor political stability and security as well as contributes to the development and promotion of political stability in the host state[21]. Foreign investors considers the political stability and security as the most critically important factor upon making an investment decision.

Furthermore, the legal and regulatory environment of host state is the second factor affecting FDI decision. Investors will consider the extent of IILs application in the host state and whether a business-friendly environment is established. This is typically dictated by the laws and regulations related to investment and its security domestically. The legal and regulatory environment of developing countries are a key motivating factor of investment decisions. As pointed in the above figure, it is mostly critically important or important for foreign direct investors. The preferred legal and regulatory environment by foreign investors in developing countries is one which conforms to international practices. For instance, countries that adopts the New York convention and are members of the ICSID convention have a higher level of attracting FDIs. Dispute resolutions with accordance to international practices are desired by foreign investors to protect and secure their investments in the unforeseen future events.

Other factors are of consideration to foreign investors prior to investing in a developing country. This includes the scale of domestic market size, economic stability and exchange rates, the state infrastructure and taxation rate. It is imperative to emphasize that well-constructed and implemented policies adopting by developing countries that aims at the two main factors of concern by foreign investors, political stability, and the regulatory environment will yield to prosperity in the other factors. Investors deciding to invest in developing countries that is politically stable and adopts a positive regulatory environment will assist in developing the country infrastructure and participate in developing labors skills.



Source: [35]

The above graph illustrates the global FDIs inflows between 1990 to 2021. The least developed countries have not witnessed significant rise in FDIs over the past two decades in comparison the world. This includes 33 countries in Africa and 9 in Asia. Undoubtedly, the regional political stability and security as well as the lack of business-friendly environment has been an affecting factor to attracting FDIs. Developing economies have witnessed a steady rise of FDIs inflow over the past two decades reaching from around \$33 million dollars in 1990 to more than \$850 million dollars in 2021. This steady rise can be attributed to globalization and the international investment comparative approach adopted by countries.

Positive investment claimant in developing countries will promote and attract international investments. The general concession is that a host state friendly and open to investments encourages and attracts FDIs. The quality of the regulatory framework adopted by developing countries is detrimental to the FDI inflows. States that adopt IILs practices increases its conformity to international standards. Rule-based and incentive-based approaches must be adopted by developing countries to attract foreign investors. this approach has been adopted by Singapore and resulted to FDI playing a critical role to its economic development [22]. In the late 60s the government of Singapore has provided foreign investors with generous fiscal incentives to attract foreign investments [22]. The incentive-based approach was very successful, and Singapore is considered as a leading example. Similarly, developed its rule-based approach with regards to settlement of foreign disputes. The use of arbitration in Singapore is considered very developed and separated from judicial interference. Allowing the effective and efficient use of arbitration as the preferred dispute resolution method by foreign investors has helped in attracting FDIs. The Singapore international arbitration center is considered a leading international arbitration center selected by foreign parties. Therefore, developing countries hoping to increase FDI need to utilize the available internationally accredited regulatory framework to create a positive environment climate to attract foreign investors that results in economic growth and social prosperity.

4 Conclusion

In conclusion, the nature of IIL has evolved over the years and encompasses number of essential mechanisms and fundamental principles. Developing countries aiming for economic growth can utilize the different types of treaties accredited internationally. Nonetheless, consideration to the fundamental principles of IIL, such as equitable and fair treatment, must be reflected within the national regulatory framework and adopted policies.

Conformity to international practices and the application of IIL in the host state will attract foreign direct investors. This require adopting an effective dispute resolution method to deal with FDI disputes. Developing countries are required to provide an

attractive investment environment, that is politically stable and adopt a regulatory framework that is clear and align with international practices. Furthermore, countries must utilize the rule based and incentive based approach to attract FDI and realize its benefit. Economic growth and social prosperity positively correlate with FDI in the host country and considered advantageous in the long term.

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Primary Paper Section: A

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INTERDISCIPLINARY APPROACH OF PASTORAL COUNSELING IN HELPING RELATIONSHIP

^aMARTA ANDRAŠČÍKOVÁ

^aTheological Faculty of Trnava University
Kostolná 1, 81499 Bratislava, Slovakia
email: marta.andrascikova@gmail.com

Abstract: Pastoral counseling is an integral approach that sees a client in the context of the integration of the whole personality. This article explores counseling as an interdisciplinary practice at the intersection of theology and social sciences. It defines counseling conceptually, describes its dynamics as a supportive relationship between the professional and the client, and compares the common features and differences between counseling, psychotherapy, and spiritual direction. Finally, it discusses the goals and principles of pastoral counseling specifically, characterizes the personality of the pastoral counselor, describes the dynamics of the process itself, and describes the method of therapeutic intervention.

Key words: counseling, spiritual direction, pastoral counseling, integration

Introduction

Pastoral counseling brings a new perception of the concept of counseling that takes into account the whole person with their biological, psychological and spiritual side. It appears as an interdisciplinary field of theology and psychology.

It emphasizes the basic principles of counseling, empathy, listening, and highlights building a relationship with the client as a core value, opening the client to personal growth, insight into their inner self and leading them to a change related to new knowledge, acquired skills and also coping with stressful and burdensome situations.

It highlights the need to integrate professional skills and spiritual values in the process of accompanying the client. It presents professional preparation and intervention in practice, based on the model of Loyola University's Department of Pastoral Counseling in Maryland.

1 Counseling

The topic of counseling seems to be a recent phenomenon that seeks to interconnect overly stressful professions. It is not directly related to training and the educational process, but enters into it, thus helping the client to overcome difficulties. It touches little on maladaptive behavior and structural change of personality, but helps it to accept reality and to seek appropriate ways of integrating into the world. It does not deal purely with personality disorders and does not use medication to deal with reality. May (2001) sees the role of the counselor as the one who deals with problems that are, for example, difficult for a teacher to deal with within the teaching process, but are not yet of such magnitude and depth as to require a consultation with a psychologist or psychiatrist.

Counseling according to Cavanagh (1982) indicates the relationship between the professional and the person seeking help. It is a relationship in which not only the use of professional skills is important, but also the atmosphere in which counseling takes place, in order to help the client find a relationship with themselves and also with others through appropriate productive ways.

Lartey (2003) lists seven key elements of counseling by which a counselor:

1. has to be professionally trained for this service
2. has to be in a relationship with the person being helped
3. needs both professional skills and personal characteristics for such service
4. helps the client acquire new skills
5. teaches the client to build a relationship with him/herself
6. shows how to create relationships that promote growth
7. expresses the relationship between the counselor and the client through the counseling process.

Lambourne (1988) says that the heart of counseling is promoting the uniqueness and dignity of the client. It is a relationship based on a skilled professional who offers the client an opening up, the acquisition of new inner knowing, and who helps the client to recognize the cause and affectivity of their behavior. Thus, counseling as described by Lambourne (1988) is based on skills, principles that promote self-knowledge, emotional acceptance, growth, and optimal development of personal resources. Overall, it provides the client with the opportunity to live a full and satisfying life.

Based on the above, we can say that the novelty of counseling is to answer questions within a given approach to the client, namely: how can the counselor be qualitatively differently present for the client? How can the counselor create a significantly different environment from the client's previous experience? Lartey (2003) argues that it is important for the counselor to help the client recognize negative self-evaluations, internal conflicts, negative imperatives, conflicting needs, and mistaken attitudes. In the same way, the counselor guides the client to come to terms with reality, to expand his or her self-knowledge, to be able to form new relationships, and to foster growth toward inner freedom.

Models of counseling are based on the basic schools of psychology. Psychodynamically oriented approaches are focused on the client's inner knowledge. Cognitive-behavioral approaches focus on changing the client's external behavior. Humanistic approaches are oriented towards creating relationships in the here and now, and transpersonal approaches, such as logotherapy, help to search for and discover the meaning of life.

May (2001) sees the difference between counseling and psychotherapy as

1. Counseling is more focused on personal growth, psychotherapy on deviance.
2. Counseling is more educational, supportive, reality-oriented and short-term. Therapy is more focused on personality reconstruction, is confrontational and long-term.
3. Counseling is more structured and goal-oriented, working with specific goals. Psychotherapy is more ambivalent, has goals that are evaluated in parallel with the therapeutic process.

Lartey (2003) stresses that all the psychological approaches mentioned have in common what characterizes any counseling, namely: listening, empathy, respect, cordiality, sincerity, concreteness, confrontation, discretion, immediacy. They are essential skills in any helping profession. They are also necessary in accompanying people on their spiritual journey.

2 Spiritual Direction

The basic motive of spiritual direction is spiritual growth, relationship with God and discernment of spirits that takes place in a relationship. Barry and Connolly (1982) state that spiritual direction is in a way an art, science and help given by one Christian to another. The one who wants to be guided chooses the accompanist. The authors, in their long experience, have developed a definition where they characterize spiritual direction as the help given by a Christian to another Christian in order to make him attentive to God who speaks to him personally, to dispose him to respond to his call, and to enable him to grow in intimacy with God and to help him to accept the implications of this relationship. Central to this type of spiritual direction is experience, not ideas, "any experience with that Other whom we call God" (Barry and Connolly, 1982, p.8).

In spiritual direction, complete freedom in the choice of the director is necessary, as well as complete trust in order to be able to confide everything to him or her. On the part of the director there is the capacity for relationship and witness. This is done through interpersonal skills through which the accompanist

creates an atmosphere of acceptance and understanding, which does not equate to affection. It promotes authenticity and genuineness, and knows how to navigate what is important. It reflects experience, is in touch with reality, and is aware of the cultural, religious and spiritual context of the accompanied. Medically, he or she has no serious neurotic or narcissistic difficulties, and can handle transference and the desire to fulfill their own needs, leading them to be free of their practices and techniques (ibid.).

We can say that from the time of Christ until well after the Reformation, little distinction was made between psychological and spiritual disorders. Many forms of insanity were thought to be spiritual problems caused by demon possession or moral deficiencies. This approach continued until the 19th century. Even after medicine began to develop and physical explanations for organic diseases emerged, psychology remained tied to faith and morality.

Change came with Freud and his psychoanalytic theory. His new approach suggested that the human mind could be studied scientifically through observation and measurement. This new turn took psychology out of the realm of the spirit and rooted it in empirical research. Within a few decades, psychotherapy and psychology replaced spiritual and moral guidance as the main method of alleviating mental suffering. There was a sudden boom in psychological theories that dealt not only with mental disorders but with all areas of human life and human development. In general, we could say that people began to turn to psychologists with their problems, while religious practices became emptied and lost their life-transforming power (May, 1992). It seemed that the faith tradition and spiritual direction that continued to be offered in the church no longer satisfied people's need for wholeness, health and happiness.

The first attempts of integration began among Protestant ministers who had completed psychological training and integrated these new disciplines into their ministry. The practice of pastoral counseling and clinical pastoral education was born. In these settings, clergy could provide people with individual in-depth counseling, but in most cases this counseling was increasingly psychological and less and less spiritual (May, 1992). Gradually, various churches began to integrate psychology as a helping tool, although there has always been some distrust and some resistance to psychology in church circles, and it continues to be there up to this day.

We can see that empirically based research is leading to the recognition that spirituality may be part of the solution for many people, while for others spirituality may be part of their problem. Surveys also show that people want spiritually sensitive help (Pargament and Murray-Swank, 2005). This suggests that spirituality cannot be separated from psychotherapy, and there is a growing conviction that spiritually integrated counseling can work (Kovari, 2016).

3 Pastoral counseling

The main role of pastoral counseling is to help clients cope with emotional, moral and physical stressors, as well as to help them cope with crisis and loss of meaning in life. Pastoral counseling as described in the 2014-2015 Loyola University Maryland Graduate Programs Handbook is defined in psychological rather than religious language. The program itself is holistically oriented and helps the person search for the meaning of life in all its complexity. It is eclectically focused, incorporating person-centered approaches, namely cognitive, behavioral, psychodynamic, and working with family systems. It views human behavior and human experience as an integration of psychological, intellectual, emotional, social, and spiritual dimensions. It defines pastoral counseling as a supportive relationship that intentionally includes in its approach a client's openness to spirituality and religion, with the goal of the client's growth on an emotional and psychological level. This approach has undergone many evolutions into the form we know it today. Pastoral counseling, according to Lartey (2003), is counseling that focuses on the whole person and their well-being as someone who is

part of a family - a social unit. The client is seen as a whole person with body, mind and spirit, with reference to their psychological, theological and ethnic background. In pastoral counseling, the person is guided to understand their issues in the context of everyday experiences, because through them they can find the answer to their questions. Pastoral counseling uses resources that emphasize the counselor's ability to relate to people, to motivate and guide them to take risks and make choices that will help them to be whom they are meant to be. The author mentioned above states that in pastoral counseling different approaches are defined:

- Secular approach - is focused on the personal welfare and wellbeing of the person being cared for.
- Religious - takes into account the client's religious beliefs insofar as the client brings them to counseling.
- Christian - is from a biblical, strongly evangelical perspective that includes elements of Protestantism. It is a direction that currently accepts and implements both scientific research as well as the theological aspect.

In terms of content, pastoral counseling is more structured and more complex compared to spiritual conversation. It needs an official requirement, is followed by setting time and space, and an agreement on payment. In this it is similar to psychotherapy. To do it, the person providing such help needs appropriate training and skills in the helping profession.

According to Montgomery (2010), there are three types of pastoral counseling:

- Short-term - one problem-solving session;
- A time-limited form that uses problem-solving or solution-focused methods and which usually lasts two to five sessions;
- Long-term form, called pastoral psychotherapy, whose approach depends on the therapeutic school and focuses on personality change (Kovari, 2016).

4 Comparison of counseling, spiritual direction and pastoral counseling

Stewart-Sickling (Lecture, 2014) explains the difference between counseling, pastoral counseling and spiritual direction as helping approaches.

The first approach is hedonistic, which pursues what is beneficial for the person. Religious and spiritual resources are used more as a means to meet emotional, mental and physical needs. The counselor must know the client's resources and culture.

The second is health, which is expressed through a eudaimonic approach - living a good life, strictly from a health perspective. The counselor assesses everything related to a person's developmental periods. The psychological and spiritual approach is part of the conversation, as values and tradition help to describe goals. The counselor is more informed about the client's tradition of faith and values.

The third approach is holiness, which is also related to the eudaimonic approach, but is more focused on the person's moral attitude, their desire and pursuit of beatitude. The counselor looks at things from God's perspective. Religion and spirituality are shaped by life itself. In this approach, the spiritual perspective influences all the other perspectives. Values and traditions are central, explicit, and the guide and the client have a commitment to deepen the client's faith.

Based on these three goals, Stewart-Sickling (ibid.) says that counseling is concerned entirely with the first and partly with the second. Spiritual direction deals partly with the second and wholly with the third. Pastoral counseling deals with wholly the first, partly the second, and partly the third.

Consequently, during pastoral counseling, what is important is pastoral presence that cannot be seen or heard, that cannot be

physically touched; it is an inner attunement to the client, and this takes place in the person of the pastoral counselor.

4.1 The pastoral counselor

Pastoral counselors are characterized by sense of awe, reverence, and mystery. They live in the presence of God and are aware of the power of their own presence as they let God's healing power shine forth. They are characterized by personal integrity, maturity. They know pain and suffering from their own experience, so that they become able to be with others in their suffering without being swept away by it. They are able to enter into a therapeutic relationship that is rooted in well-grounded theoretical knowledge and ethical behavior. They are reconciled to themselves, to others and to God and are able to promote reconciliation and transformation. Pastoral helping professionals live and practice in a "circle of grace" (Wicks, 2007).

Barry Estadt, co-founder of the Department of Pastoral Counseling at Loyola College in Maryland, captures the very essence of the profile of the pastoral helping professional: "The pastoral counselor ... is a [religiously] (today we would say spiritually) integrated person, ... who approaches others with a sense of mystery, ... together with the ability to enter into communion with others in the context of therapeutic help, ... with the aim of reconciliation and personal religious integration." Jordan (1986) understands the counselor as a guide to a good life who steps forward and serves as a living example along the way. Townsend (2009) emphasizes the necessity for the pastoral counselor to be personally and religiously integrated, successful in his or her own therapy, and able to demonstrate, form, and sustain a therapeutic relationship with the client. True presence requires a counselor's heart that facilitates a genuine attunement to the client that goes from heart to heart. It is a space in which the counselor understands the client more deeply.

4.2 Dynamics of the pastoral counselor

Cheston (2000) expresses this in the paradigm of pastoral counseling where she describes the dynamics of the pastoral counselor and the process itself as:

- The way of being

Cheston (2000) says that what makes pastoral counseling unique is the person doing the counseling. It is their way of being, who that person is, the degree of empathy they have, the values they present, the boundaries that are clearly set and the importance of the relationship with the client.

- They way of understanding

Cheston (2000) says that the way of understanding the client is a major part of the counseling process. It is based on knowledge that is based on theoretical approach and structure, normal and abnormal development and different ways to effect change. The counselor uses different variations of skills, forms of approach and techniques.

- The way of intervening

The method of intervention is the work itself; it is the means through which the counselor interprets the client's dysfunctional cycles and encourages the process of alternative thinking, feeling and behavior.

Pastoral integration therefore occurs when we can define the helping relationship as a method of healing (therapeutic) intervention that takes place within a constructive, creation-affirming theology (Cooper - White, 2011).

The helping relationship becomes pastoral not because spiritual topics are addressed in sessions or issues of the client's faith or religious practice are discussed. The client may not even be religious at all and may not be interested in any spiritual topic, but the helping relationship will still be pastoral because of the integrated presence of the practitioner that makes the "spiritual force field" tangible and operative in the therapeutic encounter.

5 Conclusion

We can see that pastoral counseling is entering into a special relationship with the client and deepening the pastoral approach - which can be described as bringing my spiritual self into the process of therapy with the client (seen through a theological vision). This situates pastoral counseling as an interdisciplinary approach between theology and the social sciences.

Pastoral counseling seems to be a new phenomenon in our cultural environment. It is important that in defining this ministry or profession, we also communicate with practitioners from other helping professions to seek a definition that takes into account the whole person developing within the context of our cultural, social, moral, and spiritual values.

Wicks (2012) states that we cannot give what we do not have, therefore it is important for the pastoral counselor to be rooted in their religion, practicing a long term spiritual life, such as meditation, prayer, reflection, spiritual reading and spiritual direction. Implementing these practices will help them to be humble, compassionate, and grateful. These elements are essential qualities for developing a healing relationship in the counseling room.

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EFFECTIVE TAXATION IN THE CONTEXT OF MICROECONOMIC FACTORS AFFECTING COMPANIES OF THE EU MEMBER COUNTRIES

^aALENA ANDREJOVSKÁ, ^bJOZEF GLOVA

Faculty of Economics, Technical University of Košice, Boženy Němcovej 32, 040 01 Košice, Slovak Republic;
email: "alena.andrejovska@tuke.sk, "jozef.glova@tuke.sk

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Abstract: Currently progressing globalization has supported a simple transfer of capital among countries. Investment allocation can be a difficult task for investors. Investors have a tendency to seek a country in which they will pay the least tax. The presented article approaches the issue of the relationship between selected microeconomic determinants, namely the size of the company, capital intensity and company indebtedness, inventory, profitability of the company and the nominal tax rate and their impact on the effective tax rate, with the expectation that the deciding determinant will be the size of the company. The impact of the selected microeconomic determinants on the effective tax rate is followed via quantile and regression analysis. The analyses include data from the financial statements of 1 651 production companies based in the European Union. The information about the companies comes from the Orbis database and the studied time period are the years of 2009 through 2018. The result of the analysis points towards a positive relationship between effective tax rate and the size, indebtedness and inventory of the company and the nominal tax rate. There exists a negative relationship between the effective tax rate and the physical capital and profitability of the company. The performed analysis confirms a competing theory, i.e. the fact that larger companies have lower effective tax rates, because they possess more power and a higher amount of resources, thanks to which they can influence the amount of their taxes.

Keywords: effective taxation, tax rates, microeconomic indicators, size of the company

1 Introduction

In the 1960s, Jorgenson and Hall (1967, pp. 391-414) pointed out an effective tax rate which includes multiple factors rather than only statutory tax rate. Effective tax rate is simply the quotient of the tax burden and the tax base. Effective corporate tax rates consider the statutory tax rate but also aspects of the tax systems which determine the full sum of the effectively paid taxes. The differences between statutory and effective tax rate can, in some cases, be significant. A situation might occur when countries with a high statutory tax rate reduce the amount of the tax base or the tax enforceability.

Effective tax rates are useful not only to investors but also politicians, economists and other subjects which are trying to create positive conditions for an inflow of foreign capital into the economy. If a high effective tax rate dissuades investors from choosing a given country as their target destination, it is up to politicians to make their country more attractive through effective measures.

The objective of this article is to express the currently applicable relationships between selected microeconomic determinants (size, indebtedness, capital intensity, inventory and nominal tax rate) and the effective tax rate. The regression and quantile analysis uses data from financial statements of 1 651 companies active in the industrial sector in member countries of the European Union. The input data come from the Orbis database for the period of 2009 through 2018. We expect that the size of the company is the deciding determinant of the amount of the effective tax rate.

To include the possible nonlinear impacts of explanatory variables in relation to the effective tax rate faced by the companies, the article uses quantile regression in order to follow heterogeneous behavior on the different levels of dependent variables. Quantile regression minimizes the deviations in the absolute value with asymmetrical weights rather than minimizing the squares of the errors. The results of quantile regression are compared with the results of the method of the smallest squares, which is used in the classic linear regression model.

The article consists of the following parts. The literature review points out existing empirical evidence of the existence of various relationships between selected microeconomic determinants and the effective tax rate. The methodology part describes the selected quantile and linear regression, as well as the used data. The following part, results, describes the achieved results of the analysis, and the discussion part contains a summation of the results and their comparison with previous empirical studies.

2 Literature review

Microeconomic determinants significantly impact the height of the effective tax rate of individual companies. The important determinants include the size of the company, capital intensity, company indebtedness, inventory, profitability and also the nominal tax rate determined by the state where the given company is based. Existing studies do not show a clear relationship between selected determinants and the effective tax rate.

One of the most significant determinants which affect the effective tax rate is the size of the company. This factor is often studied in the literature and studies almost always point it out as a determinant which has a predictive power over the effective tax rate. The relationship is, however, not clear. Zimmerman (1983, pp. 119-149) finds that larger companies are associated with higher effective tax rates than smaller companies. This is explained using the theory of political expenses. According to this, paid taxes are a tool of transferring assets from companies to other social groups, which means that tax rates are a certain form of repaying political expenses. The existence of this theory in practice is confirmed by Kim & Limpaphayom (1998, pp. 47-68).

A competing theory suggests that larger companies have lower effective tax rates because they have more power and more resources, which enable them to control their taxes. This negative relationship between the size of the company and the effective tax rate is confirmed by multiple studies (see Dyreng et al., 2008, pp. 61-82; Richardson & Lanis, 2007, pp.689-704). This negative relationship is also pointed out by Richardson & Lanis (2007, pp.689-704), Delgado et al. (2012, pp. 160-165), Derashid & Zhang (2003, pp. 45-62). Developing economies can, however, show a different relationship between the size of the company and the ETR. This finding is sensitive to the choice of the effective tax rates and the time of the study. Large companies in developing countries have lower tax rates than small companies.

The way in which companies manage their financial resources is important for the financing of potential investments. Companies have two possible ways to fund their activities, namely debt financing and equity financing (Ribeiro, 2015).

A negative relationship between indebtedness and tax burden was evidenced by Stickney & McGee (1982, pp. 125-152). This opinion is not shared by Kraft (2014, pp. 1-19), who failed to confirm the existence of a negative impact of indebtedness on taxation. Existing empirical studies also show a positive relationship between indebtedness and the effective tax rate. A positive relationship only exists to the degree to which companies are motivated to increase their indebtedness in order to decrease their taxation (see Chen et al., 2010, pp. 41-61; Feeny, 2006, pp. 1167-1175; Harris & Feeny, 2003, pp. 951-958; Janssen, 2005, pp. 47- 66). this nonlinear relationship is confirmed by Fernández-Rodríguez & Martínez-Arias (2011, pp. 381). Kim & Limpaphayom (1998, pp. 47-68) a Wilkinson et al. (2001, pp. 157-175) failed to find a significant relationship between indebtedness and the effective tax rate of a company.

The asset composition can have a significant impact on the ETR faced by the companies. In all tax regimes, companies are usually entitled to have deductions of long-term tangible assets.

This means that companies with high tangible investment assets should have lower tax burden than companies with a low amount of tangible assets usable for deductions. In some countries, tax stimuli are used to gain tangible investment assets. A negative impact on the effective tax rate was confirmed in capital intensity by Hanlon & Heitzman (2010, pp. 127-178). An increase in the amount of physical capital brings about a reduction in the effective tax rate of the company. The claimed reduction in the effective tax rate will be even higher than the increase in physical capital of the company. A negative relationship between the effective tax rate and physical capital is also mentioned by Richardson & Lanis (2007, pp.689-704), who evaluated companies and their capital intensity in the context of deductions. They discovered that a company with a higher amount of physical capital in its possession can more easily manage taxes, for example by postponing expenses on deductions.

A higher amount of tangible investment assets leads to a lower ETR. This is proven by Chen et al. (2010, pp. 41-61), Derashid & Zhang (2003, pp. 45-62), Fonseca Díaz et al. (2011, pp. 491-516), Gupta & Newberry (1997, pp. 1-34), Janssen (2005, pp. 47- 66), Noor & Fadzillah (2010, pp. 189) and Stickney & McGee (1982, pp. 125-152). Conversely, Feeny (2006, pp. 1167-1175), Plesko (2003, pp. 201-226) and Wilkinson et al. (2001, pp. 157-175) discovered a direct relationship between physical capital and tax burden. Other studies, however, did not discover any connection between this determinant and ETR (Liu &

Cao, 2007, pp. 49-67). Fernández-Rodríguez & Martínez-Arias (2011, pp. 381) discovered a nonlinear relationship.

The asset composition is determined by the field in which a company operates. The opportunity to reach a lower ETR can also depend on the volume of current assets, which companies need for their operation. These is inventory created for a smooth operation of production. Investments in inventory are considered an alternative to investments in long-term tangible assets. The volume of inventory held by the company can be considered a reason which might lead to a larger tax burden. The volume of inventory as an explanatory variable of ETR is not represented in existing empirical research to the same degree as other determinants. Several authors, such as Gupta & Newberry (1997, pp. 1-34) and Richardson & Lanis (2007, pp.689-704) have dealt with it and the results of their studies speak to a statistically significant relationship. Other authors, such as Derashid & Zhang (2003, pp. 45-62) or Adhikari et al. (2006, pp. 574-595) have no identified any statistically significant relationship.

Profitability is the deciding factor for the tax burden of companies. The most profitable companies have the highest profit every year, which is subject to tax. Less profitable companies have lower profits. Some years, they even suffer a loss, which means they pay lower or even no taxes. Empirical evidence points to a positive relationship between profitability and ETR (Chen et al., 2010, pp. 41-61; Fernández-Rodríguez & Martínez-Arias, 2011, pp. 381; Gupta & Newberry, 1997, pp. 1-34; Plesko, 2003, pp. 201-226; Richardson & Lanis, 2007, pp. 689-704; Stickney & McGee, 1982, pp. 125-152; Wilkie & Limberg, 1993, pp. 46). Profitable companies are subject to a higher tax burden than the less profitable ones. However, there is a converse situation in Malaysia. This is proven by Derashid & Zhang (2003, pp. 45-62), Noor (2008, pp. 1602-1604) and Noor & Fadzillah (2010, pp. 189). In Malaysia, the most profitable companies have a lower tax burden due to a tax compensation provided by the government to the most effective companies. In the Spanish bank sector, Fonseca Díaz et al. (2011, pp. 491-516) did not discover any significant relationship between profitability and ETR.

Manzon & Plesko (2001, pp. 175) and Kraft (2014, pp. 1-19) are of the opinion that profitable companies are able to more effectively use tax deductions as well as tax reliefs, and consequently show higher tax differences. Companies which are more profitable have lower costs in connection to tax administration and therefore have more resources to invest in tax planning, which contributes to lowering the effective tax rates.

Nominal tax rate as a determinant of effective tax rate is statistically significant in empirical studies and positively impacts effective tax rate. (see Dias & Reis, 2018, pp. 7). Effective tax rate is, on average, increased more slowly than nominal tax rate, as claimed by Graham & Tunbridge (2016), Rego & Wilson (2012, pp. 775-810) and Rego & Wilson (2009). Companies have the ability to decrease their total payable tax through tax management. Giannini & Maggiulli (2002) and Dyreng et al. (2008, pp. 61-82) claim that if there is a gap between effective and nominal rates, the tax system is not effective. Some companies reach significant differences between a high nominal and low effective rate, which leads to undesirable impacts on the unbalanced tax system.

3 Materials and Methodology

The analysis is focused on the impact of selected independent variables (size, capital intensity, inventory, profitability and nominal tax rate) on a dependent variable (effective tax rate). The relationship between selected microeconomic determinants is analyzed through quantile regression, which divides individual companies into quantiles. The selected analyzed countries are all the member states of the EU, 28 as of 2018. The followed time period are the years 2009-2018. The data are sourced from financial statements of companies from the Orbis database. An exception is the statutory corporate tax rate, whose values were sourced from ZEW (2018). After removing companies which do not show values in certain indicators and removing extreme values which might distort the analysis, the dataset is composed of 1 651 companies based in one of the EU member states. These are production companies which are classified in group C – Manufacturing under the NACE classification of economic activities. Variables which enter into the model are selected based on the works of international authors who deal with the issue of effective corporate tax and its determinants. The selected determinants are analyzed in many works (Fernández-Rodríguez & Martínez-Arias, 2014, pp. 214-228; Fattouh et al., 2008, pp. 417-438; Hsieh, 2012, pp. 1177-1180; Gupta & Newberry, 1997, pp. 1-34; Janssen & Buijink, 2000; Richardson & Lanis, 2007, pp.689-704; Stamatopoulos et al. 2019, pp. 236-254; Feeny, 2006, pp. 1167-1175; Vintila et al., 2017; Kim & Limpaphayom, 1998, pp. 47-68; Delgado et al. (2012, pp. 160-165; 2014, pp. 487-496), which consider them to be the most significant determinants which impact the height of effective corporate rate. The selected variables entered into the analysis are:

- ETR (effective tax rate) – dependent variable defined as the ratio of common expenses on business tax and net income before tax,
- SIZE – size of the company measured as a logarithm of total assets,
- LEV (leverage) - financial leverage defined as the ratio of total debt and total assets,
- CAPINT (capital intensity) - physical capital of the company defined as the ratio of tangible assets and total assets,
- INVINT (inventory intensity) – inventory measured as the ratio of investments in inventory and total assets,
- ROA (return of assets) – the ratio of gains before tax and total assets,
- RATE - statutory (nominal) tax rate from income of judicial persons in each country per each year.

To record possible nonlinear impacts of explanatory variables depending on effective tax rate faced by the companies, quantile regression is used. This semiparametric approach was suggested by Koenker and Basset in 1978 (pp. 33-50) with the objective to follow heterogeneous behavior on different levels of dependent variables. Quantile regression minimizes deviations in their absolute value with asymmetrical weight rather than minimizing the squares of the errors. In 2005, Koenker published a book which discusses the theory of quantile regression in detail and applies it to examples from economics, finance, biology and ecology.

Let (y_i, x_i) be a population sample, whereas β_0 is the regression vector. Assuming that the zero quantile of the conditioned division is linear in x_i , the quantile regression model takes the form:

$$y_i = x_i' \beta_0 + u_{0i} \quad (1)$$

and

$$\text{Quant}_\theta(y_i|x_i) = \inf\{y: F_i(y|x) \geq \theta\} = x_i' \beta_\theta \quad (2)$$

where it is required that

$$\text{Quant}_\theta(u_{0i}|x_i) = 0 \quad (3)$$

signify the zero quantile, represent the regression vector, is the unknown parameter vector, which should be estimated for different values in the interval (0,1), is the standard error. A change in the value of θ from 0 to 1 records the whole distribution of, which is a determined variable.

In the process of quantile regression, all observations are always entered for each quantile. Each is suitable for each quantile but in the end, the pairs of sampling points are decisive, where is the number of parameters which ought to be estimated. The selection of points depends on the full number of observations in the sample. (Koenker, 2004, pp. 74,89)

To estimate the covariant matrix of the vector of regression parameters, there are two general approaches. The first one is derived from the asymptotic standard estimation error, while the second one uses bootstrap methods to calculate the standard errors and to create reliability intervals.

Any quantiles of distribution of a dependent variable determined by independent variables can be achieved by changing from zero to one using linear programming methods to minimize the sum of the weighed absolute deviations. The functions of quantile regression fit our data better than traditional estimations of OLS linear regression. Classic properties of effectiveness and estimations of minimum OLS dilution are gained using restrictive assumptions of independent, identical and normally distributed errors. When the division of errors deviates from normal, a quantile regression estimation can be more effective than OLS. (Buchinsky, 1998, pp. 88-126)

Since estimations of quantile regression are derived using the minimization of the weighed sum of absolute deviations, estimations of parameters are less sensitive to deviations in data distribution. Thus, quantile regression estimation is relatively robust in comparison with heteroscedasticity of residuals.

Quantile estimations use all observations and coefficients are estimated using the iterative method through linear programming in different places of the distribution. This method is more effective than an OLS estimation, since the distribution of errors is still nonstandard. (Buchinsky, 1998, pp. 88-126). The results of quantile regression are compared with the results of the smallest squares method, which is used in the classic linear regression model.

Existing literature and studies do not agree in determining the relationship between ETR and selected determinants. Since our analysis focuses on companies operating in EU countries between the years 2009 and 2018, we expect to confirm the following hypotheses:

Hypothesis H1: The relationship between the size of the company, indebtedness, inventory and statutory tax rate and effective tax rate is positive, and the relationship between capital intensity and profitability of the company in the industrial field is negative.

Hypothesis H2: The size of the company is the deciding determinant for taxing companies in the industrial field.

The hypotheses will be confirmed or denied based on carrying out a quantile regression of companies from the member countries of the European Union in the period of 2009 to 2018 which perform business activities in the industrial field.

4 Results and Discussion

One of the important parts of analyses is data preparation. A similar issue is addressed by Delgado et al. (2014, pp. 487-496). Using quantile regression in analyzing effective corporate tax rate is also the subject of Fernández-Rodríguez & Martínez-Arias (2011, pp. 381) and Hsieh (2012, pp. 1177-1180). After the initial reformatting and homogenization of the data set, the first part of the statistical evaluation was carried out. This is a descriptive analysis to express the basic statistical properties consisting of calculating the average value, standard deviation and the variables (Table 1). The analysis was performed in the R-commander software, version 3.6.1. (R.C. Team, 2020).

Table 1. Descriptive statistics

	average	Standard deviation	Minim.	Maxim.
ETR	0.2586	0.121	0	0.998
SIZE	11.5539	1.299	6.005	19.158
LEV	0.4120	0.189	0	0.973
CAPINT	0.3004	0.160	0.002	0.968
INVINT	0.2228	0.171	0	0.996
ROA	12.4685	9.421	0.012	85.141
RATE	0.2439	0.057	0.090	0.350

Source: Own processing – R-commander output (2020)

The average effective tax rate, which was calculated as the ratio of paid taxes and the net income before tax, is approximately 26%. ETR is close in value to the average statutory tax rate, which is 24.39%. Since these are companies operating in the industrial field, the value of assets is in millions of EUR. The average size of company in assets is approximately 104 million EUR. The average indebtedness of companies which were entered into the analysis was at 41% of total assets. Tangible assets compose on average 30% of total assets of the analyzed companies in the EU. The amount of inventory held by the companies is on average 22% of total assets. The ratio of profit and total assets is on average 12.5%.

From all the variables, a correlation matrix was created using a series of Pearson's correlation tests, out of which we are listing the correlation coefficient (r), which determines the direct or indirect proportionality in the relationship between variables and the corresponding p-value (p), which determines the potential significance of this relationship (if $p < 0.001$). Table 1. lists the descriptive characteristics and a matrix of correlations between the variables, whereas all correlative relationships, excepting two (Pearson's correlation test: SIZE vs. RATE, $r = 0.01$, $p > 0.05$; INVINT vs. ROA, $r = 0.002$, $p > 0.05$) are statistically significant, positively or negatively.

The linear dependence between selected indicators is weak. The highest absolute value is in the relationship between inventory and capital. This is a negative relationship, which is logical from a practical perspective, since companies have limited financial resources at their disposal, which they invest in purchasing tangible capital or purchasing inventory in the most beneficial ratio for them. The strongest positive relationship is between effective and statutory tax rate. The impact of STR on ETR has already been mentioned several times in the preceding chapters. STR is reflected in the height of ETR, since the statutory tax rate is used to tax assets of companies. A positive relationship between these two variables was also shown by Dias & Reis (2018). Their study focuses on only five EU countries, namely Denmark, Slovenia, Finland, Luxembourg and Great Britain.

There was no correlation proven between STR and the size of the company. This situation is explained by similar size of the companies, whose assets amount to millions of EUR, thus their assets are taxed the same. There exist no small companies in the sample which would have lower tax rates than large companies. Another relationship where no correlation was proven is the relationship between inventory and ROA (Table 2.).

Table 2. Correlation matrix

	ETR	SIZE	LEV	CAPINT	INVINT	ROA	RATE
ETR	1						
SIZE	0.03***	1					
LEV	0.18***	-0.08***	1				
CAPINT	-0.10***	-0.07***	0.08***	1			
INVINT	0.18***	-0.08***	0.31***	-0.51***	1		
ROA	-0.21***	-0.11***	-0.24***	-0.13***	0.002 NS	1	
RATE	0.37***	0.01 NS	0.16***	-0.18***	0.24***	-0.05***	1

Note.: ***, **, * a „NS“ refers to the level of statistical (in)significance at the values of 5%, 1%, a 0,1 %

Source: Own processing; R-commander output (2020)

Consequently, we proceeded to do the partial modeling of relationships between a dependent variable – effective corporate tax rate (ETR) and six independent variables – size of the company (SIZE), financial leverage (LEV), physical capital (CAPINT), amount of inventory (INVINT), profitability of the company (ROA) and statutory tax rate (RATE), through creating six quantile regression models with nine quantile levels (from $\tau = 0.1$ to $\tau = 0.9$ with an interval of 0.1). As the algorithmic method used to calculate the position of individual quantile curves, we used a modified version of Barrodale's and Roberts' algorithm (described in detail in Koenker and d'Orey (1994, pp. 410-414). This method is relatively effective for datasets sized up to multiple thousand observations. It also implements a method for calculating the intervals of reliability for the

estimated parameters (β_0 and β_1), which is based on an inversion of the values of the test described in Koenker (1994, pp. 349-359).

The values of the coefficients (β_0 a β_1) together with their standard deviations and p-values are listed for each value of τ in a table, as well as a graph. The values of the locating constant β_0 are listed in Annex B. The individual pictures (Figure 1., Figure 2., Figure 3., Figure 4., Figure 5., Figure 6) show red constant lines which represent the estimated coefficients using the method of the smallest squares, and a 90% reliability interval. The gray portion represents 90% reliability intervals for individual regression coefficients depending on quantiles.

Tab. 3 Estimators of quantile regression – Intercept β_1

	Quantiles								
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
SIZE	-0.00026 NS (0.00166)	0.00052 NS (0.00091)	0.00368 *** (0.00054)	0.00604 *** (0.00081)	0.00523 *** (0.00078)	0.00398 *** (0.00072)	0.00342 *** (0.00074)	0.00371 *** (0.00083)	0.00408 ** (0.00155)
LEV	0.04831 *** (0.01062)	0.04559 *** (0.00535)	0.05119 *** (0.00366)	0.09456 *** (0.00495)	0.10933 *** (0.00559)	0.10597 *** (0.00526)	0.11638 *** (0.00541)	0.13612 *** (0.00578)	0.20579 *** (0.00920)
CAPINT	-0.10212 *** (0.00952)	-0.09146 *** (0.00805)	-0.06489 *** (0.00348)	-0.09737 *** (0.00454)	-0.11475 *** (0.00618)	-0.11004 *** (0.00644)	-0.08147 *** (0.00660)	-0.05677 *** (0.00758)	0.00212 NS (0.01316)
INVINT	0.11198 *** (0.01075)	0.07477 *** (0.00494)	0.09300 *** (0.00575)	0.13208 *** (0.00616)	0.13822 *** (0.00573)	0.13070 *** (0.00556)	0.12011 *** (0.00512)	0.13291 *** (0.00745)	0.19922 *** (0.01356)
ROA	-0.00081 *** (0.00007)	-0.00076 *** (0.00014)	-0.00082 *** (0.00002)	-0.00149 *** (0.00006)	-0.00200 *** (0.00002)	-0.00226 *** (0.00010)	-0.00247 *** (0.00004)	-0.00298 *** (0.00008)	-0.00373 *** (0.00008)
RATE	0.66971 *** (0.03629)	0.65496 *** (0.01691)	0.76587 *** (0.01296)	0.82426 *** (0.00799)	0.90951 *** (0.00626)	0.96108 *** (0.01137)	1.00151 *** (0.01809)	0.80733 *** (0.02265)	0.78522 *** (0.03561)

Source: Own process; R-commander output (2020)

The results of individual tests are shown in the summary tables and also in graphic visualizations, using both p-values determining the test result and standard codes of significance: *** if $p < 0.001$; ** if $p < 0.01$; * if $p < 0.05$; NS if $p > 0.05$. Data manipulation, as well as all statistical calculations and modeling were performed in the environment of the programming language “R” version 3.6.1 (R Core Team, 2019) using the libraries „readxl“ (Wickham & Bryan, 2019), „Hmisc“ (Harrell & Harrell, 2019, pp. 235-6) and “quantreg” (Koenker, 2019). Graph outputs were edited in the program Inkscape (Harrington & Engelen, 2004). It is important to note that the breadth of 95% of confidence intervals for the coefficients is very narrow, which suggests above-average precise estimations

of these values – from this we can conclude that the sample was sufficiently large and the used methods adequate.

Based on performing quantile regression, we will confirm the validity of the above-mentioned hypotheses formulated based on our expectations and existing empirical evidence.

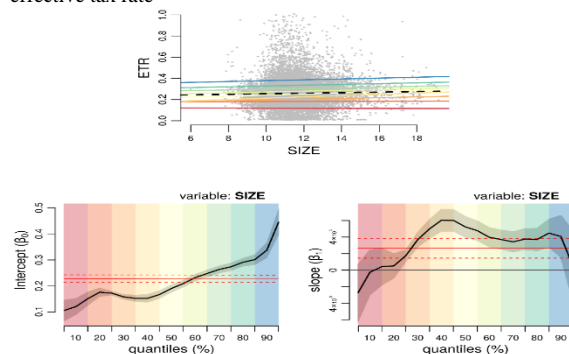
From the perspective of the dynamic of coefficient values β_0 (Annex 1) and β_1 (Table 3.) across quantiles, we can conclude that all the created quantile regression models evidence the existence of strong positive (SIZE, LEV, INVINT, RATE) but also negative (CAPINT, ROA) relationships between ETR and the other six economic indicators, whereas the character of these relationships is, with a few exceptions, identical for all quantiles. The exemptions are only with the 10% and 20% quantile of the

size of the corporations (SIZE). With such small subjects, the additive effect of ETR on RATE is statistically indemonstrable.

Hypothesis H1: The relationship between the size of the company, indebtedness, inventory and statutory tax rate and effective tax rate is positive, and the relationship between capital intensity and profitability of the company in the industrial field is negative.

The relationship between ETR and SIZE is an often present subject of various studies, Kim & Limpaphayom (1998, pp. 47-68), Richardson & Lanis (2007, pp.689-704), Delgado et al. (2012, pp. 160-165), Derashid & Zhang (2003, pp. 45-62). The results of these studies vary, due to the time when they were performed but also due to tax jurisdictions they focus on. This fact is confirmed by Wilkie & Limberg (1990, pp. 76-91) and Kern & Morris (1992). Some of them point to a significant and positive relationship (Kim & Limpaphayom, 1998). This fact supports the political cost hypothesis which claims that politicians have the power to redistribute wealth of the companies through corporate income taxes, regulations, subsidies, etc. This idea comes from (1971, pp. 3-21), Peltzman (1976, pp. 211-240) and Jensen & Meckling (1978, pp. 31-37). In Figure Error: Reference source not found 1 we can see that this hypothesis applies, if unevenly, across the whole sample of selected companies. Effective tax rate increases in a relative stable and monotonous way with the increasing size of the corporation. The impact of ETR and size of the company is most felt by corporations in the size quantile between 40% and 50%. For companies in the size quantile between 10% and 20%, the effect of ETR is nonexistent. It is important to note that reliability intervals estimated for the size variable are very narrow. All the companies in the examined sample showed a profit in the examined period. Settling a loss is different in different countries, which can distort results to a significant degree. In the case of Slovakia, we can see that different governments implemented different rules. For example tax license, which did not allow companies not to pay income tax, since even companies which had a loss in the tax period had to pay certain legally set tax rate. Another example is accepting a tax loss through dividing into multiple tax periods, which lowers the tax base and thus the paid amount of corporate income tax.

Figure 1. Relationship between size of the company and effective tax rate

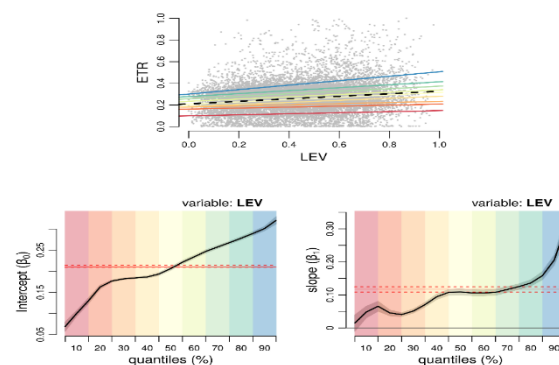


Larger companies reach a higher value of ETR, since they are oftentimes more legislatively burdened than smaller companies, who get various tax reliefs from policy-makers. Larger companies are subject to higher tax controls or different government controls. An exception are companies in the 90% quantile, which can use their size and economic power to influence the taxation of their net income, for example through tax holidays or very beneficial tax reliefs as a compensation for investments in a given area and employing a significant portion of the population in a region. This theory is known as competition theory and claims that larger companies have lower effective tax rates because they have more power and more resources through which they can influence the amount of paid taxes. This relationship is confirmed by multiple studies (Dyreg et al., 2008, pp. 61-82; Richardson & Lanis, 2007, pp.689-704).

Another reason might be the fact that large companies make large investments which are reflected in their financial statements as increased operating costs, which decreases the tax base for paying the taxes on net income.

The relationship between effective tax rate and indebtedness of the company is also strong and positive. (Error: Reference source not found Figure 2.). The higher the indebtedness, the higher the ETR, whereas this relationship is most progressive (steepest curve) for corporations with indebtedness in the highest quantile (90%). in the manufacturing sector, it is necessary for companies to own various machinery, buildings, land and other tangible and intangible assets, the purchase of which requires significant financial resources. These resources are usually borrowed from banks and other financial institutions. Significant indebtedness is mostly seen with large companies (size of the company is measured through assets that it owns). Large companies have no problems with borrowing money, since they can use their assets as collateral. Financial leverage was measured as the total indebtedness versus total assets. In other words, the higher the indebtedness of the company, the higher the effective tax rate.

Figure 2. Relationship between indebtedness of the company and effective tax rate

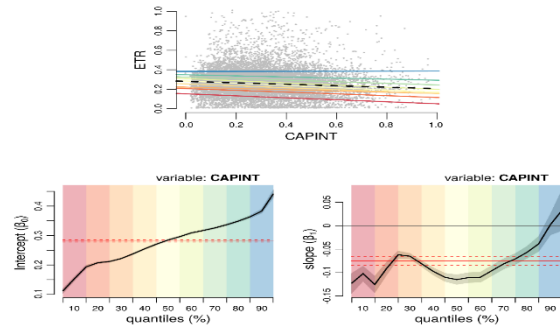


A positive relationship between ETR and indebtedness of the company was proven in Chen et al. (2010, pp. 41-61), Feeny (2006, pp. 1167-1175), Harris & Feeny (2003, pp. 951-958) and Janssen (2005, pp. 47- 66). Companies are willing to take on debt, but only to a certain degree. One important finding is the fact that interest from loans and other borrowed resources is a taxable expense In many European countries, and this decreases the tax base used to calculate the payable corporate income tax. The results of our analysis are in agreement with theoretical arguments which support a positive relationship between ETR and indebtedness of companies, which are under a lot of fiscal pressure in terms of provided stimuli to decrease indebtedness, thus decreasing their effective tax rate. The indebtedness of the companies has certain limits. One of them is the amount of financial resources that a company has at its disposal to pay back the debt. Thus, we can assume that under certain circumstances, the relationship between ETR and indebtedness is nonlinear, which is also suggested by Fernández-Rodríguez & Martínez-Arias (2011, pp. 381).

Capital intensity represents the ratio of tangible and total assets. Physical capital is connected with accounting and tax write-offs. The write-offs are a tax expense which decreases the tax base used for calculating corporate income tax. The methods and times for write-offs vary across EU countries. The total of the write-offs is also called a tax shield or tax relief which is provided to companies indirectly by the state. Tangible assets which are subject to write-offs are used to decrease the value of the effective tax rate. The analysis points to a strong negative relationship. This negative relationship is confirmed by Stickney & McGee (1982, pp. 125-152) and Gupta & Newberry (1997, pp. 1-34). Companies with a low amount of assets that can be written off are not able to decrease their tax burden. Conversely, companies which reach a certain level of capital show a decrease

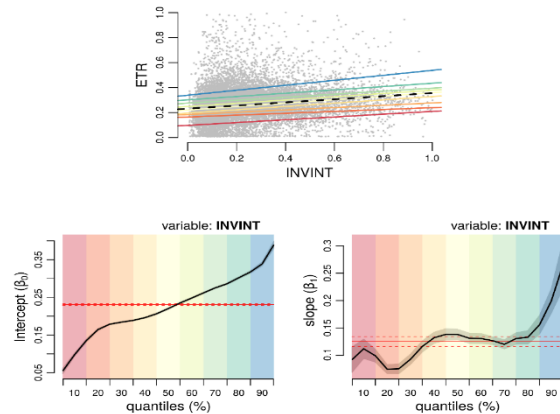
in ETR, resulting from the ability to have high write-offs. In our analysis, the relationship is the most significant for companies with physical capital in the 10%, 50% and 60% quantile. For companies in the 90% size quantile, the effect of ETR is nonexistent.

Figure 3. Relationship between capital intensity of the company and the effective tax rate



The relationship between the effective tax rate and inventory is strong, positive and the most significant for corporations with inventory in the 90% quantile. In the manufacturing sector, it is important to keep the necessary volume of inventory in stock, so that manufacturing is not stopped in case delivery is delayed by a couple days. These current assets are necessary for undisturbed operation of the companies. Investments in inventory are considered an alternative to investments in long-term tangible assets. The volume of inventory held by the company can lead to higher tax burden. A statistically significant relationship has also been confirmed by Gupta & Newberry (1997, pp. 1-34) and Richardson & Lanis (2007, pp.689-704). An important part of current assets is their discharge from storage at different prices. There are four ways to discharge inventory, namely FIFO (first in first out), LIFO (last in first out), weighed arithmetic average and set prices. Not all tax jurisdictions allow a choice from these four options. Tax burden varies. The highest tax burden happens with discharging with set prices, and the lowest with discharging while accounting for price increases – LIFO.

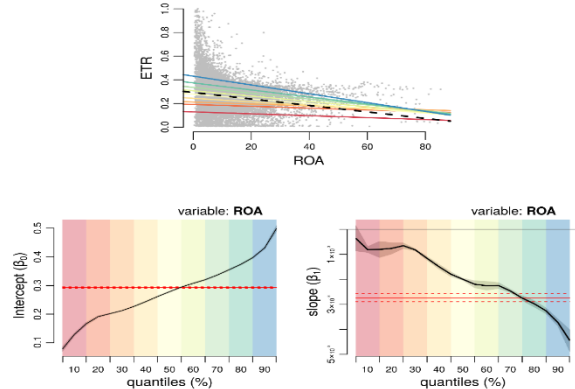
Figure 4. Relationship between inventory of the company and effective tax rate



The relationship between effective tax rate and profitability of the company is the strongest negative relationship of all models and at the same strongly monotonous. The higher the corporation is, i.e. the higher the profitability quantile of the company, the lower the value of its effective tax rate. From a theoretical perspective, one might expect higher taxes along with higher profits. The results of our research claim the opposite. This opinion is shared by Manzon & Plesko (2001, pp. 175), Kraft (2014, pp. 1-19), Stickney & McGee (1982, pp. 125-152), Wilkie & Limberg (1993, pp. 46), Gupta & Newberry (1997, pp. 1-34), Plesko (2003, pp. 201-226) and Chen et al. (2010, pp. 41-61), who claim that profitable companies are able

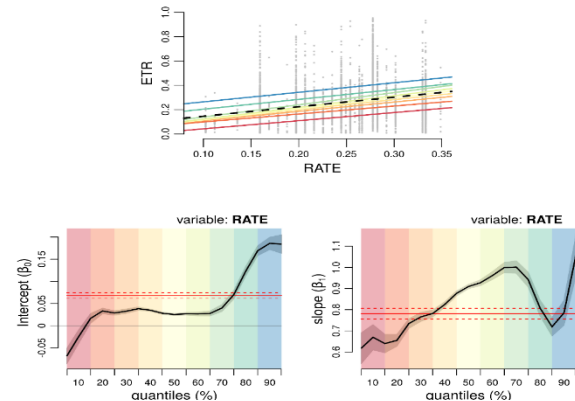
to more effectively utilize tax breaks, write-offs and reliefs, and thus lower their effective tax.

Figure 5. Relationship between profitability of the company and effective tax rate



It is important to note that the independent variable profitability was calculated using profit before tax and total assets of the company. It is important to include profit before tax in the calculation, because profit after tax and other reliefs could distort the results of the analysis. This is repeated because this is another case where a significant role is played by the size of the company. As mentioned above, large companies tend to plan their tax and also take advantage of various government stimuli, reliefs, tax holidays etc. Their profitability values, if calculated with profit after tax, would therefore be completely different. We observed a difference between the effective tax rate and statutory (nominal) tax rate at the level of approximately 1.5 percentage points, which is much lower than cited by Delgado et al. (2014, pp.487-496) – 5.5%. It is, however, important to note that the study followed the member countries of EU 15, not EU 28. The relationship between effective corporate tax rate and statutory tax rate can generally be described as positive especially for corporations with a statutory tax rate in the 70% and 90% quantile, however with a significant drop of the curve at the 80% quantile, where one might expect a higher value. Simultaneously, there is a strong correlation between these variables. The higher the value of STR, the higher the value of ETR. The statutory tax rate significantly impacts the value of the effective corporate tax rate. This relationship is visible during calculations and also during regression analysis.

Figure 6. Relationship between effective tax rate and statutory tax rate



As we were able to observe, the relationships between ETR and individual independent variables vary for the 10% to 90% quantiles. In some cases, there is a radical change within two variables. After evaluating the partial portions of the analyses, we can say that *Hypothesis H2: The size of the company is the deciding determinant for taxing companies in the industrial field has been confirmed by the analysis.*

The tax rate for corporate income tax is an important data point in the European tax system for makers of fiscal policy, companies, and investors. On the one hand, the tax rate can impact the unity of the market, on the other hand it can impact strategic decisions in the company. Using quantile regression, we pointed to an existing relationship between the effective tax rate and selected microeconomic determinants, namely: size of the company, volume of physical capital owned by the company, volume of inventory in stock, indebtedness of the company, and statutory tax rate in the country where companies are based. All the proposed hypotheses were confirmed using quantile regression. A positive relationship was shown between effective tax rate and size, indebtedness, inventory of the company and statutory tax rate. A negative relationship exists between the effective tax rate and profitability of the company and between the effective tax rate and capital intensity. These hypotheses apply to companies based in the member countries of the European Union. Assuming that large companies own a large volume of physical capital and inventory and are the most indebted. It is important to realize that companies with a size in the 90% quantile operate under specific rules. These companies

have the ability to regulate their effective tax rate using their economic power. Banks and other financial institutions are willing to lend large companies a large volume of financial resources. If this assumption is true, we can say that large companies are more indebted, which means that the curve shows the most rapid growth in this quantile. Companies which entered into the analysis are from the industrial field. In the industrial field, the companies own physical capital of high value which they regularly write off. It is therefore odd that the analysis pointed out that companies with physical capital in the 90% quantile (assuming these are large companies), then the effect of the effective tax rate will be nonexistent. Since inventory increases the effective tax rate, this relationship is true for large companies with a high ratio of inventory in total assets. A negative relationship between the effective tax rate and profitability of the company is very progressive and rapidly drops in the 90% quantile. This confirms that large companies have the ability to use their good standing in the economy and their economic power to influence the amount of taxes that they must pay.

Table 4. Comparison of previous empirical studies with our analysis

Variable	Existing empirical studies			Our analysis		
	Author	Year	Relationship between ETR and variable	Expected relationship	Discovered relationship	Interpretation
Size	Delgado et al.	2012	negative			Increased size of the company means increased its effective tax rate (ETR).
	Wu et al.	2012	nonexistent			
	Dyreg et al.	2008	negative	+	+	
	Richardson & Lanis	2007	negative			
	Derashid & Zhang	2003	negative			
Kim & Limpaphay	1998	positive				
Capital intensity	Kraft	2014	negative			The more physical inventory a company owns, the lower its ETR due to higher deductions of assets.
	Richardson & Lanis	2007	negative	-	-	
	B. - Semenescu & Semenescu	2010	nonexistent			
Indebtedness	Chen et al.	2010	positive			Indebtedness of the company increases its effective tax rate.
	Feeeny	2006	positive			
	Janssen	2005	positive	+	+	
	Harris & Feeny	2003	positive			
	Wilkinson et al.	2001	nonexistent			
Kim & Limpaphay	1998	nonexistent				
Inventory	Richardson & Lanis	2007	positive			Increased amount of inventory in stock causes an increase in effective tax rate.
	Adhikari et al.	2006	nonexistent	+	+	
	Derashid & Zhang	2003	nonexistent			
	Gupta & Newberry	1997	positive			
Profitability	Armstrong et al.	2012	positive			The higher the profitability, the lower the effective tax rate of the company. Large companies with high profitability can use their economic power to influence the amount they pay in tax.
	Fonseca Díaz et al.	2011	negative			
	Chen et al.	2010	negative			
	Noor & Fadzillah	2010	negative			
	Minnick & Noga	2010	positive			
	Liu & Cao	2007	nonexistent	-	-	
	Feeeny	2006	positive			
	Janssen	2005	negative			
	Plesko	2003	positive			
Wilkinson et al.	2001	positive				
Nominal tax rate	Dias & Reis	2018	positive			Increased nominal tax rate means increased effective tax rate.
	Graham & Tunbridge	2016	positive	+	+	
	Rego & Wilson	2012	positive			
	Giannini & Maggulli	2002	positive			

Source: Own processing

5 Conclusion

Corporate taxes represent one of the important income sources to the state budget. The statutory and effective tax rate is an important factor for investors when deciding where to place their investment. Companies try to find a country where they will pay the least in corporate tax. The solution, however, is not to find the country with the lower statutory tax rate, but the lowest effective tax rate. For the company, this will mean not only the lowest percentage of the tax base from the net income that will have to be paid to the government, but also a lower inflation rate, interest rates for foreign capital, more beneficial conditions for writing off long-term assets and other factors which the company encounters on a daily basis. All of this constitutes the calculation of the effective tax rate.

The results of the quantile regression, which used data from financial statements of 1 651 companies from the industrial field

based in the countries of the European Union from the years 2009 to 2018, showed significant relationships between the effective tax rate and selected microeconomic determinants, namely size of the company, capital intensity and indebtedness, inventory, profitability and nominal tax rate. Quantile regression confirmed our proposed hypotheses about the relationship between the effective tax rate and determinants. A positive relationship was proven for the size of the company, capital intensity, indebtedness, inventory and nominal tax rate. A negative relationship exists between the effective tax rate and profitability of the company. An important output of the quantile regression was pointing out large companies, which can use their economic power to regulate their effective tax rate but also other determinants. The results of quantile regression need to be observed from a broader perspective, since it is important to see hidden connections. The observed phenomenon applies to the above mentioned large companies with an amount of total assets owned in the 90% quantile. Based on the results, we can conclude that these companies pay much lower taxes than other

companies, which placed in different quantiles. Large companies also have high indebtedness, since financial institutions are willing to lend them money before small and medium enterprises. A similar situation arises with capital intensity and inventory of these large companies. Since the analysis included industrial companies, the capital intensity required for their operation and the volume of inventory held in stock are key for undisturbed manufacturing. The curves showing the relationship between determinants and the effective tax rate have a more significant downward slope in the 90% quantile. An important relationship is between the effective tax rate and profitability of the company. Quantile regression showed that the higher effective tax rate, the lower the profitability of the company.

We cannot forget that the European Union consists of countries with varying levels of economic development, and thus different rules in the domestic tax systems. To collect corporate income taxes, one must understand the deciding factors which affect them. One of these factors is the effective tax rate, which reflects the operation of the whole tax system in a country. A lack of unity in fiscal policies, specifically in the tax area, in the member countries of the European Union, creates a competitive environment. To create the same tax conditions in all member countries, the European Union has attempted to implement a tax harmonization multiple times. It has never been successful, however. Countries worry about losing competitiveness and are not open to such a change. It is disputable whether it will ever be possible to implement a tax harmonization.

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Primary Paper Section: A

Secondary Paper Section: AH

Appendix 1. Quantile regression estimators (Intercept β_0)

		Quantiles								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
SIZE		0.12086	0.17605	0.15838	0.15279	0.19041	0.23200	0.26336	0.29102	0.33733
		***	***	***	***	***	***	***	***	***
		(0.01914)	(0.01031)	(0.00590)	(0.00604)	(0.00523)	(0.00846)	(0.00861)	(0.00965)	(0.01784)
LEV		0.10003	0.16271	0.18204	0.18643	0.20628	0.23408	0.25747	0.27827	0.30121
		***	***	***	***	***	***	***	***	***
		(0.00400)	(0.00284)	(0.00123)	(0.00176)	(0.00257)	(0.00236)	(0.00219)	(0.00227)	(0.00309)
CAPINT		0.15310	0.20742	0.22177	0.25478	0.28477	0.30911	0.32588	0.34898	0.38307
		***	***	***	***	***	***	***	***	***
		(0.00382)	(0.00201)	(0.00147)	(0.00194)	(0.00212)	(0.00199)	(0.00193)	(0.00224)	(0.00411)
INVINT		0.09759	0.16450	0.18420	0.19608	0.22027	0.24826	0.27522	0.30192	0.33882
		***	***	***	***	***	***	***	***	***
		(0.00254)	(0.00192)	(0.00104)	(0.00138)	(0.00174)	(0.00160)	(0.00134)	(0.00187)	(0.00318)
ROA		0.12886	0.19136	0.21221	0.24355	0.27822	0.30765	0.33615	0.37385	0.43097
		***	***	***	***	***	***	***	***	***
		(0.00261)	(0.00180)	(0.00094)	(0.00156)	(0.00139)	(0.00158)	(0.00140)	(0.00160)	(0.00246)
RATE		-0.02458	0.03331	0.03289	0.03496	0.02530	0.02652	0.03992	0.12318	0.18568
		**	***	***	***	***	***	***	***	***
		(0.00926)	(0.00388)	(0.00306)	(0.00158)	(0.00138)	(0.00257)	(0.00479)	(0.00648)	(0.00837)

Source: R-commander output (2020)

EVALUATING THE EXPERIENCE WITH WORK FROM HOME

^aMILUŠE BALKOVÁ, ^bKLAUDIE DVOŘÁKOVÁ, ^cBLANKA BOROVKOVÁ

^{a,b}*Institute of Technology and Business in České Budějovice, Okružní 517/10, 370 01*

České Budějovice, the Czech Republic
e-mail: balkovam@mail.vstecb.cz

^c*Pan-European University, Bratislava, Faculty of Economics and Business, Department Management and Marketing, Tematínská 10, 851 05 Bratislava, Slovakia*
email: ^abalkovam@mail.vstecb.cz, ^b26665@mail.vstecb.cz, ^cborovkovablanka@gmail.com

This paper is a partial output of the project of the Institute of Technology and Business in České Budějovice, "TVSUPS2303 - Identification of elements of ethical management and CSR in SMEs".

Abstract: Work from home has become a part of everyday life for most of us. Due to the COVID-19 pandemic, it has become a necessity rather than a formerly desired benefit. An important part of this way of working is its effect on workers and how workers have handled this phenomenon of modern times. The objective of the paper was to find out how office workers perceived the transition to work from home during the COVID-19 pandemic. The paper also examined whether office workers perceived higher productivity when working from home and whether they were able to separate private and work life. Data from a questionnaire survey distributed to 33 employees of a project office of the company T-Mobile Czech Republic a.s., who compared their experience with working from home before the pandemic and during the lockdown. The data obtained were then evaluated on the basis of relative frequency. The results show that employees were more productive when working from home, both before the pandemic and during the lockdown. At the same time, most employees did not have problems separating private and work life, unlike working parents, who reported problems related to online education during the lockdown. These findings represent certain benefit for HR departments, who can, based on these findings, decide on the length of working from home. The findings also form a basis for considering how to help employees to adapt to this newly emerged trend.

Keywords: work from home, home office, COVID-19 pandemic, productivity, employees, private and work life

1 Introduction

Work from home, home office (hereinafter referred to as HO), telework, and others have become increasingly more important nowadays. Besides being a very desired benefit in most large and medium-sized enterprises, it also becomes a tool to protect the health of population. If not for concerns about COVID-19, most trade companies would have not introduced HO to such a large extent (Belzunegui-Eraso, 2020).

Many companies experienced working from home during the COVID-19 pandemic for the first time, since it was the only possibility to keep their business running. More experienced companies, which had already been practising this way of working even before the pandemic, could test the functioning of the systems set and the effectiveness of their employees when working from home in the long run. Unlike the Western European countries and the USA, the Czech society was not prepared well for such a situation. In 2013, one-third of Czech companies enabled their employees to work from home (Čaha, 2018). Vrchota et al. (2020) conducted a survey involving a total of 1018 small and medium-sized enterprises in the CR before the outbreak of the pandemic. According to the findings, about 60 % of companies in the Czech used a form of HO. In the USA, it was more than 70 %.

The reason why a lower percentage of Czech companies are interested in HO compared to foreign companies consists in the doubts whether working from home is effective. Another obstacle was a lack of legislation (Vrchota et al., 2020). Despite the concerns of companies in general, the share of employees working from home rocketed due to the efforts to stop the spread of the new disease, COVID-19. Therefore, to be able to manage the pandemic crisis, it is necessary to analyze employee attitude to working from home (Zöllner and Sulíková, 2020). This issue is dealt with by the research group of Schade et al. (2021), who found that employees are able to adapt to the change in the working environment while remaining productive. Awada et al.

(2021) concluded that women and high income or older employees showed higher productivity. Based on their research outputs, Schade et al. (2021) recommend employers to foster employee intrinsic motivation through a sense of autonomy and competences. This way, a lack of interaction with colleagues might not represent such a big problem, if employees feel they may rely on them if necessary (Ližbětínová, 2017).

Working from home brings certain advantages and disadvantages both for employers and employees. The main advantages include e.g. cost savings and increased employee performance. Moreover, when set up properly, working from home increases employee loyalty and satisfaction (Vrchota et al. 2020). Hau and Todescat (2018) stated that working from home enables better work-life balance. The disadvantages of HO include e.g. worse connection of employees with the organization, extended working hours due to more frequent breaks, and difficult communication between employers and employees. For some employees, it might be difficult to separate work and private life, which may result in increased stress. It shall be noted that what is perceived as disadvantage may be an advantage for other employees. The preference for working from home is related to personality traits of employees. Vrchota points to the fact that more introverted employees tend to prefer HO as opposed to extroverts who find working from home frustrating (Vrchota et al. 2020).

The objective of the paper was to determine how office workers perceived the transition to work from home during the COVID-19 pandemic.

2 Literary research

Many authors have been dealing with the issue of the impact of working from home on employees. Based on the search in databases (PsychInfo, ProQuest, and Web of Science) for the years 2007-2020, Oakman et al. (2020) states that the effects of HO on employee physical and mental health are very different. Employee health was influenced by the availability of support from organization, support from colleagues, external contacts outside the organization, and the degree of conflict of work and family requirements. Women reported higher level of fatigue and stress compared to men.

Based on the results of a questionnaire survey conducted at the beginning of the COVID-19 pandemic, Xiao et al. (2021) concluded that working from home might have been more difficult for women, since they usually tend to take more responsibility for household chores and other activities at home. Also, working mothers might have felt pressure caused by lack of support in home schooling and childcare. According to the research by Lonska et al. (2021), it was difficult for employees to reconcile work and personal life, especially in the case of women at the age of 18-44 and respondents who lived with minor children. According to Thompson et al. (2021), before the pandemic, the third most common motivation (answered by 25 % of the respondents) for working from home was tend to family demands. Employees also experienced less conflicts of family and work when working from home compared to when working in an office (Darouei and Pluut, 2021). Employees who took care of young children during the pandemic showed a lower level of productivity, while in the case of taking care of teenage children, the effect was opposite (Awada et al., 2021). Similarly, Ipsen et al. (2021) found that during the closure of schools and kindergartens, people working from home, who took care of children, showed lower productivity than childless employees. Using online survey, the authors found that working from home increased employee productivity in general. According to the respondents, the advantages of HO include the protection against the spread of the infection and the disease, saving of time necessary for commuting and higher flexibility in terms of having more time for meals and breaks. Most respondents lacked social contact with colleagues. Another disadvantage was the

impossibility to separate work and home environment and unsuitable conditions for working from home. The issue of productivity was dealt with e.g. by Galanti et al. (2021), whose research showed that fear of the disease increases productivity, since working from home reduces the fear of possible infection. According to the research by Zöllner and Sulíková (2021), employees, who are allowed to work from home, will be willing to do so to protect themselves against illness.

Research by Beno and Hvorecky (2021) also dealt with the issue of productivity when working from home. Before the outbreak of the pandemic, during the lockdown, and after the lockdown, the authors sent questionnaires to employees in Austria. The results showed that employees with many years of experience did not show higher productivity in any of the periods but they found that employees who did not like working from home were less productive. The reasons that reduced productivity included childcare including home schooling, looking after pets, caring for others when working, routine work, or less work. Productivity was also addressed by Stefan (2021), who used a questionnaire survey focused on employees in Romania and found that in the first months of the pandemic, productivity increased in more than a third of them. A half of them reported fatigue caused by longer working hours.

Based on an online questionnaire focused on employees in Italy, Awada et al. (2021) did not report any change in the overall perception of the level of productivity of employees compared to their productivity when working in the office before the pandemic. However, the number of hours spent working increased by about 1,5 hours at HO. The research showed a very low correlation between relative productivity and change in hours spent working from home. More hours spent working were reported by individuals who had school children, owned office desk or adjustable chair and had adjusted their working hours. However, research conducted in Italy by Moretti et al. (2020) shows that employees felt less productive but less stressed than when working in office but just as satisfied.

Online research by Mihalca et al. (2021) showed that work performance and work satisfaction during the COVID-19 is affected by situational (family, work, organization) factors and individual factors. The authors also found that workload is a significant indicator of productivity and satisfaction with work but not of work performance. A surprising finding was that the support from organization did not influence productivity or satisfaction with work. Nemteanu et al. (2021) concluded that remote work does not have a significant impact on work performance, but influences counterproductive work behaviour, which is caused by insufficient communication with superiors.

Pfeifer (2021) is one of the few authors who focus on mental health and work attitudes of Czech employees and managers during the COVID-19 pandemic in the year 2020. The data were obtained using an online survey focused on industrial companies, which received the same questionnaire every month. Based on the literary research, it was confirmed that people who worked remotely are at higher risk of suffering from social isolation, which is closely related to stress (Jurasek, 2021). During the lockdown, this feeling was even stronger. Unlike employees, managers perceived negative impacts on psyche less negatively than employees. This may be due to learned discipline and better self-management that managers use on a daily basis (Pfeifer, 2021).

The impacts of remote work could differ by working conditions in individual countries as well as given quarantine measures adopted due to the global pandemic (Nemteanu et al., 2021).

In order to achieve the objective of the paper, the following two research questions are formulated: 1) Did office workers perceive higher productivity when working from home? 2) Were office workers able to separate work and private life?

3 Data and methods

3.1 Data

The basic data source is a questionnaire survey consisting of 7 closed and 4 open-ended questions. Before the start of the questionnaire survey, the so-called preliminary research will be carried out. The preliminary research will have a form of an interview with 2 respondents, who provide feedback concerning whether the respondents understand the question.

Subsequently, 50 questionnaires will be distributed in person in the headquarters of T-Mobile Czech Republic a.s. The questionnaire survey will examine subjective views of employees mostly in managerial positions in a project office concerning their productivity when working from home, and how they managed to reconcile private and work life.

The research sample will include employees of a project office due to the fact that even before the COVID-19 pandemic, they were allowed to work from home twice a week. During the national lockdown, the situation changed and they were allowed to work in the office twice a week in line with the restrictions adopted.

In the introductory part of the questionnaire survey, respondents are asked to fill in the questionnaire and the objective of the research is explained. In the next part, there are closed questions concerning gender, age, job, and children. The most important part consists of closed and open-ended questions, which enables better understanding of the issue and the respondents will not be affected by any expected answers. The questions will concern subjective perception of the respondents' productivity and the ability to separate private and work life before the COVID-19 pandemic and during the lockdown.

3.2 Methods

All data obtained from the questionnaires will be processed in MS Excel. 11 questions from the questionnaire survey are gradually entered into each cell in the first line. The answer from a certain respondent is added to relevant question in the next line. This means that each line will be assigned to one questionnaire. The document will thus contain 11 cells in the 1st row (11 columns). Each column will contain a question and an answer from the respondents.

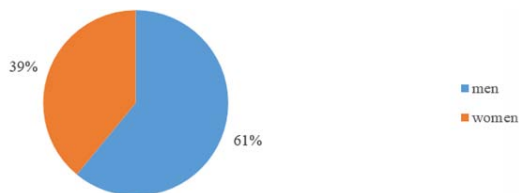
Subsequently, a table will be created to record the frequency and relative frequency to each question of the questionnaire survey. The answers to 4 open-ended questions will be evaluated and then included in the group of representative answers. The first column of the table will contain responses (e.g. strongly agree, rather agree, rather disagree, strongly disagree, don't know), the second column will include the frequency of responses, while in the third column, the calculated relative frequency of responses will be entered in percentage.

Moreover, the application of data filtering will be used to present specific data in MS Excel. The output will be a table for recording frequency and relative frequency for each finding.

The results of the questionnaire survey are presented in the form of pie charts including comments.

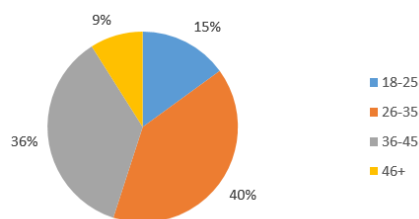
4 Results

On 1 November 2021, 50 questionnaires were distributed to the project office in the headquarters of T-Mobile Czech Republic a.s. The questionnaires were sent back after a week with the total number of 33 respondents ($n = 33$), i.e. 66 % of the employees addressed, out of which 20 were men (61 %) and 13 women (i.e. 39 %) see Graph 1).



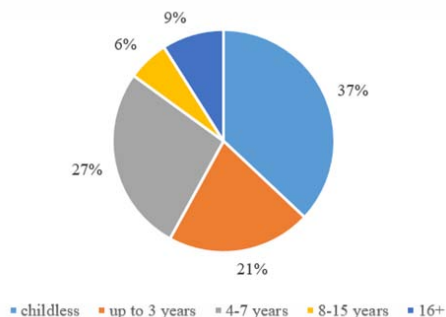
Graph 1: Structure of respondents by gender
Source: Authors

The age structure of the respondents is presented in Graph 2. As seen from the graph, 5 respondents (15 %) were at the age of 18-25, 13 respondents (4 %) at the age of 26-35, 12 respondents (36 %) at the age of 36-45, and 3 respondents (9 %) at the age of 46 and old.



Graph 2: Age structure of respondents
Source: Authors

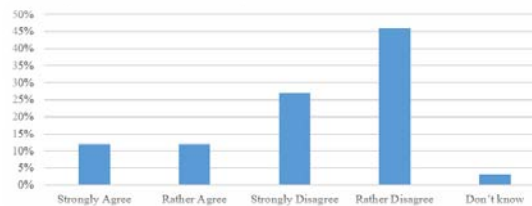
Within the survey, the respondents answered the question of how old their youngest child is. As seen from Graph 3, the highest number of the respondents did not have any children (37 %), 21 % had children under 3 years, 27 % had children at the age of 4-7 years, 6 % of the respondents had children at the age of 8-15, and 9 % had children at the age of 16 and older.



Graph 3: Absolute frequency of responses to the question of How old is your youngest child?
Source: Authors

The question of whether it was difficult for employees to separate work and private life when working from home before the COVID-19 pandemic was answered as follows: 12 % of the respondents answered “Strongly Agree” and 12 % “Rather Agree”. 27 % answered “Strongly Disagree”, 46 % answered “Rather Disagree”. 1 person stated he/she did not know the response to the question. The responses are shown in Graph 4.

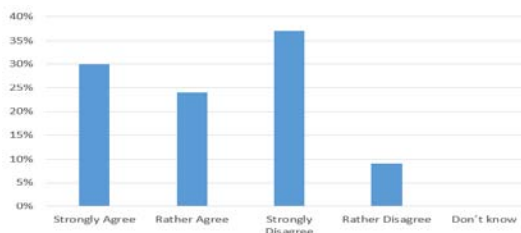
If the respondents answered “Strongly Agree” or “Rather Agree”, they did not further specify where the problems were (open-ended question). 2 out of 8 respondents stated they were not able to use time more effectively when working from home compared to working in office. Moreover, 6 out of 8 respondents specified they were distracted by various factors, such as children, meetings, housework, private matters.



Graph 4: Absolute frequency of responses to the question: Was it difficult to separate work and private life when working from home before the COVID-19 pandemic?
Source: Authors

Graph 5 shows responses to the question of whether it was difficult for employees to separate work and private life when working from home during the lockdown. 30 % of the respondents answered “Strongly Agree”, 24 % answered “Rather Agree”. 37 % of the respondents answered “Strongly Disagree”, while 9 % of the respondents choose “Rather Disagree”.

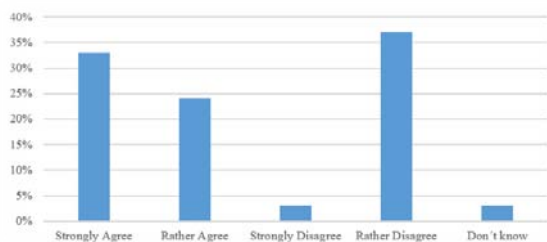
If the respondents chose positive answers, they specified the problems in more detailed (open-ended question). 1 out of 18 respondents answered that he/she is not able to use their time more efficiently when working from home than when working in the office. For 2 out of 18 respondents, it was difficult to schedule their time for work, while 10 out of 18 respondents were distracted by children during their online lessons. 2 out of 18 respondents stated that social distancing decreased their motivation to work.



Graph 5: Absolute frequency from the application of data filtering: Was it difficult to separate work and private life when working from home in the lockdown?
Source: Authors

Graph 6 shows the responses to the question of whether the respondents perceived higher productivity when working from home before the COVID-19 pandemic. 33 % of the respondents answered “Strongly Agree”, 24 % chose “Rather Agree”. 3 % of the respondents answered “Strongly Disagree”, while 37 % of the respondents chose “Rather Disagree”. One respondent chose the “Don't know” option.

When deciding for a positive answer (“Strongly Agree”, “Rather Agree”), the respondents specified in more detail how the higher productivity showed (open-ended question). 1 out of 18 added he/she was able to organize the work at the expense of his/her private life, and tended to work more. 5 out of 18 answered there were fewer disruptive elements and they could thus concentrate better on their work. Similarly, 3 out of 18 were not distracted by colleagues and they could thus concentrate better. 9 out of 18 mentioned saving time for commuting and could use it better.

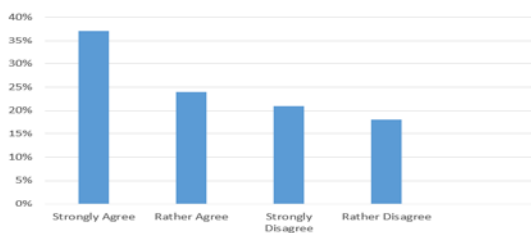


Graph 6: Absolute frequency of responses to the question: Did you perceive higher productivity when working from home before the COVID-19 pandemic?

Source: Authors

Graph 7 shows the respondents' answers to the question of whether they perceived higher productivity when working from home during the lockdown. 37 % of the respondents answered "Strongly Agree", 24 % "Rather Agree". 21 % of the respondents chose "Strongly Disagree" and 18 % "Rather Disagree".

In case of a positive answer, the respondents further specified (open-ended question) in which sense they perceived higher productivity. 1 out of 18 mentioned better time management, 2 out of 18 used the same explanation but added that it was at the expense of their private life. 5 out of 18 mentioned fewer disruptive elements. The remaining 10 respondents answered they saved time for commuting.

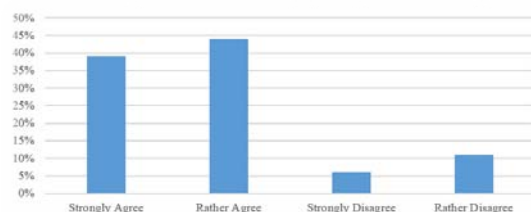


Graph 7: Absolute frequency of answers to the question: Did you perceive higher productivity when working from home during the lockdown?

Source: Authors

The last graph (Graph 8) shows the responses to the question of whether employees who lived with children under 15 years had difficulties to separate private and work life during the lockdown.

The answer "Strongly Agree" was chosen by 39 % of the respondents, while 44 % answered "Rather Agree". 6 % of the respondents answered "Strongly Disagree", while 11 % chose the answer "Rather Disagree".



Graph 8: Absolute frequencies in the application of data filtering. Question: perceived difficulties to separate private and work life during the lockdown in the case of employees living with children under 15 years.

Source: Authors

5 Discussion of results

Based on the findings from the questionnaire survey, it is possible to answer the formulated research questions:

1) Did office workers perceive higher productivity when working from home?

The data obtained showed that more than 50 % of the respondents perceived higher productivity when working from home even before the pandemic. This is in line with the findings of Ipsen et al. (2021), according to whom working from home increases employee productivity. The conclusion of Awada et al. (2021) and Beno and Hvorecky (2021) is in contradiction to these findings, as they did not notice any change in perceived productivity from the side of employees working from home before the pandemic. Beno and Hvorecky (2021) continued in their research and concluded there was no change in productivity during the lockdown, either. Nevertheless, the respondents participating in the research presented in this paper perceived slightly higher productivity when working from home before the pandemic. According to Ipsen et al. (2021), childless employees showed lower productivity compared to their colleagues living with children, but overall, employee productivity was higher. Schade et al. (2021) state that despite the change in the working environment, employees are able to adapt to the changes.

Employees with perceived higher productivity stated that they saved time as they did not have to commute to work. Some of them also argued that there were no disruptive elements when working from home. For some respondents, working from home enabled better organization of work time but at the expense of their private life. These situational factors are also mentioned by Mihalca et al. (2021), according to whom they had impact on employee productivity and satisfaction with work during the COVID-19 pandemic. It follows from the conflicting results of research on productivity that there are many factors affecting employee performance when working from home. In general, it is thus possible to agree with the findings of Schade et al. (2021), who argue that office workers are able to adapt to working from home.

The second research question (see below) could be answered as follows:

2) Were office workers able to separate work and private life?

Before the pandemic, only about a quarter of the respondents had difficulties to separate personal and private life when working from home, which means that for most employees, it was not difficult to separate private and work life. The respondents were mostly distracted by children, meetings, housework, and private matters. This is in line with the research by Hau and Todescano (2018), who claim that according to employees, work-life balance is one of the advantages of HO. On the other hand, according to Vrchota et al. (2020), the effort to keep work-life balance can be a disadvantage for some people, causing them stress.

Based on the results of their research, Lonska et al. (2020) state that especially in the case of women, time for work and for family started to overlap with the outbreak of the COVID-19 pandemic. Our research confirmed that during the lockdown, a number of employees who found it difficult to separate work and private life grew by approx. 25 %. Working parents with young children mentioned home schooling as the most frequent disruptive element for their work. The majority of parents with children under 15 had difficulties to separate work and private life. This finding is in line with Lonska et al. (2021), who stated that based on their research results, for parents with minor children, it was difficult to reconcile work and private life during the lockdown. Moreover, they found that this was also problem for women at the age of 18-44. The research conducted indicate that it is important to find out how to help employees who have difficulties to reconcile work and private life to work better.

When interpreting the findings of the research conducted, several limitations need to be taken into account. The first limitation was a small sample size. For this reason, the responses were not further analysed in terms of the respondents' gender, which would have helped achieve more detailed results. The

respondents were mainly managers, i.e. people with higher education. Besides, the research was limited to employees of a project office in the company T-Mobile Czech Republic a.s. in Prague. It shall also be noted that the research considered subjective employee perception of their productivity. To achieve more objective results, the research should include also the superiors and the results should be mutually compared to find out whether they correspond with the subjective employee perception.

It follows from the above that further research is needed on the impact of HO and gender differences. In this sense, there is also a need for further research focused on the issue of work-life balance. Given the current situation, research should be carried out within a longer period in order to obtain objective results.

The data and findings can be used by HR department of the company when considering whether to increase or reduce the number of days the employees are working from home in order to boost their productivity.

6 Conclusion

The objective of the paper was to find out whether office workers perceived higher productivity when working from home and whether they were able to separate work and private life. The objective of the paper was achieved. The data from respondents are analysed on the basis of their absolute frequency in the chapter "Results".

It follows from the data obtained that office workers showed higher productivity before the COVID-19 pandemic, which even increased slightly during the lockdown. Moreover, the results showed that employees did not have any difficulties to separate private and work life before the COVID-19 pandemic, but during the lockdown, problems with separating work and private life more than doubled from the 25 % before the pandemic. More specifically, this problem applied mainly to parents of children under 15 due to the closure of schools and home schooling.

The findings can be used by HR departments for employees in managerial positions. The fact that the research was conducted on employees in selected positions in specific departments is a limitation of the research. Another limitation is the fact that only the subjective perception of employee productivity from the side of employees, and its objective evaluation from the side of superiors was not included. Due to the small sample size, it was not possible to analyse the responses by men and women separately, which would have helped find more detailed answers.

From the above, the following questions arise: How can employers help working parents when working from home? What is the difference between the employee productivity perceived subjectively by employees and how superiors perceive the productivity of their subordinates? How does productivity of men and women differ when working from home? Therefore, it is necessary to conduct further research that would provide answers to these questions and thus help companies to be able to adapt to the current situation and cooperate with employees working from home.

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Primary Paper Section: A

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3D MODELLING AND ITS USE IN EDUCATION

^aMILAN KLEMENT, ^bKVĚTOSLAV BÁRTEK

Faculty of Education, Palacký University, Žižkovo nám. 5, 771 40, Olomouc, Czech Republic
 email: ^amilan.klement@upol.cz, ^bkvetoslav.bartek@upol.cz

Abstract: Technology surrounds us in everyday life and its control is becoming not only a social but also a necessity of life. One of the manifestations of these trends is the growing interest in 3D modelling, which is becoming an integral part of the curriculum in some primary schools. The inclusion of 3D modelling followed by 3D printing represents an innovative way of using modern information and communication technologies in education. Its impact can positively influence the development of key learning activities for primary school pupils where such a focus is implemented. The aim of the research work carried out in this paper was to map out the use and benefits of 3D modelling in selected primary schools, including a systematic description of specific tools for the implementation of such focused teaching, based on pedagogical research methods.

Keywords: innovation in education, primary schools, technical education, 3D modelling.

1 Introduction

Technology is part of our lives, it is all around us. It can be stated that a person without the necessary basic technical knowledge and skills would not be able to perform his social function and lead a full life (Dostál, 2019; Dixon, 2013; Zubatá, Plishke, Kropáč, 2011 and others). Therefore, the education system must make elementary technical knowledge and skills available to the entire population, not only to students of technically oriented schools. In developed school systems, this elementary technical education is an integral part of the basic general education that takes place in primary and secondary schools. This is done by means of teaching subjects which, both at home and abroad, have not only different names (work education, work education, technical education, technical practice, technical work, technology, practical activities, technology, etc.) but also different scope and content. In recent years, the term "technical education" is often used in the literature (Idrus, Mond, & Abdullah, 2015). Through them, students are equipped not only with theoretical knowledge but also with elementary work skills. The emphasis is usually on technical creative activities according to the pupil's interest (predominant in elective subjects). In spite of the rapid development of digital technologies, elementary manual work activities of a technical nature (woodworking, metalworking, working with tools and simple machines, electrical work, etc.) are maintained in all educational systems of developed countries, but increasingly we see a combination of both areas. The aim of technical or polytechnic education and training is to develop the learners' skills in handling tools and machines, to acquire a working culture and to acquaint them with the scientific principles of contemporary production, rules of work safety, etc. (Mojžíšek, 1981). Today, these objectives are further developed to include the use of digital technologies to support these activities, as these technologies now cover or support a significant part of industrial production. In technically oriented subjects, when there is a combination of the two segments of the objectives mentioned above, this task can be well fulfilled, their content and procedural aspect being close to the performance of many professions, today not only professions referred to as technical (Manullang, Kons, 2012).

Thus, it is becoming a natural and common phenomenon that many designers, engineers and scientists from various fields, need to use 3D modeling in their work. Even younger children are beginning to use different kinds of technology (Klement, Klementova, 2015). Thus, it is not surprising that in some primary schools there is already a tendency to start introducing 3D modelling and 3D printing software into the curriculum (Bai et al., 2021). This is also due to the fact that a number of software companies have opted for favourable licensing policies for educational purposes. Some applications are completely free, some are even available online, and are web browser based. In some cases, pupils, students and educators can

learn to work with the same version of the software on which professionals create their products. Even for primary school children, working with 3D modelling can be beneficial and bring many benefits (Klement, 2017; Atkinson, 2012). There are modelling programs that are very intuitive and easy to understand, in addition to giving children a great experience of their own creation. Children are getting beyond just simple drawing. 3D modelling in conjunction with 3D printing is a good way to motivate children to create a variety of objects and stimulate their creativity. The programmes target all children - boys and girls. It creates good conditions for both groups to realise their ideas. The fact that they strongly encourage girls in particular is an important and very good input for the future - for example, for choosing a profession (Bybee, 2019).

2 Possibilities of using 3D modelling in primary school

For young children (first grade), it is necessary to start with programs that have a simple and appealing interface, are easy to understand, intuitive. Fortunately, there are also such solutions on offer. Especially suitable for a class of first grade children are online applications. Many programs also offer an "EDU educational version" that helps students and teachers communicate about the project (Ertmer, 2020). These versions allow teachers to monitor students' work. For upper grade students, it may be appropriate in some cases to reach for basic versions of more complex 3D modelling programs with more sophisticated editing tools. Although most pupils are unlikely to become industrial designers, understanding the basic elements and principles of 3D modelling and 3D printing is important for pupils and can be used in practical life. It is noticeable that more and more disciplines are using 3D visualisation or 3D modelling. The basic knowledge gained from creative experiments with these programs in primary school can subsequently direct pupils to further study in specialized fields in secondary schools, or will be of great benefit in the workplace (Dostál, 2019; Klement, 2017).

There are different perspectives among educators and parents on the question: when should a child actually start using 3D modelling programs? One group is more conservative and leans towards the student learning to draw in the hand first. Using traditional tools such as: pencil, compass, ruler, they take the view that a person's basic literacy includes the ability to express oneself graphically without a computer (Granath, 2003). When drawing in the hand, there is a richer development of sensitivity, perception, psychomotor skills. Children then better understand the continuity with the work of previous generations (draughtsmen, graphic artists, etc.) who did not have 3D modelling programs. The second group classifies these listed aspects as rather secondary, and does not prevent pupils from using technology to start drawing and expressing their ideas. A similar analogy can be seen, for example, in the disagreement amongst graphologists as to whether to persist with stick writing or to try to introduce a font closer to print - that is, a more legible font such as (for example) Comenia Script.

Thus, the question of when to start drawing and graphing with 3D modelling software cannot be answered in a clear and decisive way (Hallstöröm et al., 2013). In our opinion, it is not even relevant whether or not the child first has to learn to draw so-called "by hand". What is essential is that one or the other form of skill is not completely eliminated from his or her 'journey of discovery'. It is also good to take into account the experience of some designers and architects that the initial idea, the idea that stands at the start of a work or project, usually comes to them on a walk in the woods or on a plane journey. Other key factors that need to be addressed and given equal importance when teaching at primary school are the choice of a suitable 3D modelling program and its use for subsequent 3D printing.

3 3D modelling programs suitable for primary schools

From an educational perspective, 3D modelling and printing can be seen as tools that, through play, engage children in learning without their primary awareness. 3D modelling and printing fit into the concept of STEM/STEAM education (Wang et al., 2018). The aim of this concept is to create a better relationship with STEM subjects (science, technology, engineering and mathematics) in students so that an increasing percentage of graduates choose careers and professional life in this field. This concept began in the US in the 1980s, was strongly supported (also financially) during the Obama administration, and is still promoted significantly today (Sanders, 2015). Fortunately, European countries have also caught this current and have understood the warnings of economic experts, who consistently point out that not being educated in STEM will lead to a loss of competitiveness in the market and will have an adverse effect on the development of the future economy. It is a known fact that even the unemployment rate of graduates in STEM fields is significantly lower than that of graduates in other fields (Mansour, 2014).

STEM education should be tailored to each age group. Already for first grade children it is advisable to apply this type of education because they are exposed to various technologies at an early age. They start to learn about science and technology and develop their creative thinking. Pupils can use both analytical and creative parts of the brain. STEAM engages creativity and new ways of looking at technical subjects. It also addresses the issue of how to address the shortcomings of the current gender disparity in technical careers. At a younger age, social stereotypes are not yet ingrained in children. The STEM/STEAM programme seeks to address this as well. For example, it uses celebrities - famous women in the field - to show that they really belong in the world of technology. It picks up on the fact that in modern companies the female element is increasingly needed and sought after (Siekmann, 2016).

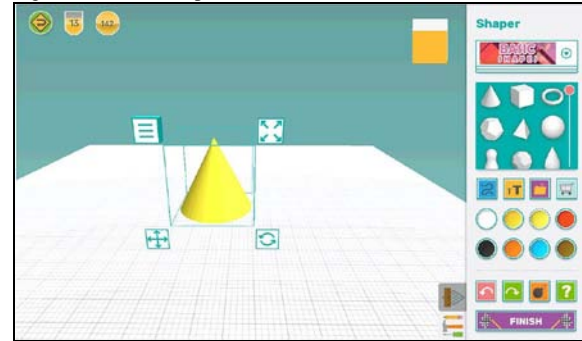
Educators in STEM fields are aware of this fact and are trying to capture innovations and issues from science and technology. Increasingly, schools are using special educational tools, educational toys, electronic building blocks, special 3D modelling programs and 3D printing in their teaching. Several such programs that can be used appropriately in the educational process in primary school computer science classes will be described in the following sections. These applications can also be used for the STEAM education concept.

4 Makers Empire

This programme has been designed specifically for younger primary school pupils. It was named one of the best educational programs in Common Sense Education's Best EdTech competition by a non-profit organization promoting digital literacy. Maker Empire is supported by ministries of education in the US, Australia, Saudi Arabia. It has become part of many educational projects in more than 40 countries. The ME School version includes more than 130 lesson plans aligned to the US Common Core standards, Next Generation Science standards, and the Australian curriculum. The software is available free to students in both desktop and tablet versions. The learning app allows you to develop spatial thinking - learning from real-world examples of architecture and real-world examples. It aims to help pupils develop logic, precision, creative thinking, spatial imagination.

The app supports the creation of 3D models, children can also download models and print objects for 3D printers. The program is also a classroom management tool with integrated assessment. Teacher, has the ability to create materials for lessons, can manage, direct students during the lesson during student work. The program also has a game zone - 3D maze. Finished models can be shared, and it is possible to work in a team on a joint project, make comments, read instructions, teacher's opinion. Every week the creators of Empire prepare a competition for students.

Figure 1: Makers Empire environment



Source: authors

5 SolidWorks Apps for Kids

Dassault Systemes SolidWorks has released some interesting 3D online apps for kids. They run directly in the web browser. It encourages children's enthusiasm for studying engineering in a fun way and helps develop technical thinking. SolidWorks Apps for Kids is aimed at children between the ages of 4 and 14. The collection of five apps allows the design process to be broken down into individual steps with tools for creating, defining style, designing a concept and then presenting and sharing it with others. The apps inspire students and give them the tools to bring their diverse ideas to life. The web-based collection of apps is also available for tablets and other mobile devices. Children can learn about the design process in a fun and exciting way.

After registration, five modules are available on the manufacturer's website: Capture It, Shape It, Style It, Mech It, Print It.

- "Capture it" creates composite images, collages and videos with sound. Children can then show off the results to their classmates.
- "Shape It" creates ideas in 3D designs. Whatever a child imagines, they can create in this intuitive and easy-to-use modelling tool.
- "Style It" adds colors, stickers, backgrounds and other elements to Shape It designs. It even lets you paint directly on the model.
- "Mech it" is used to construct motion mechanisms, including animation and trajectory rendering. It folds individual shapes and allows you to move them around. Touch links make the individual designs lighter and their behaviour matches reality.
- "Print It" prints designs in 2D, 3D or some fun project format.

Figure 2: SolidWorks Apps for Kids modules



Source: authors

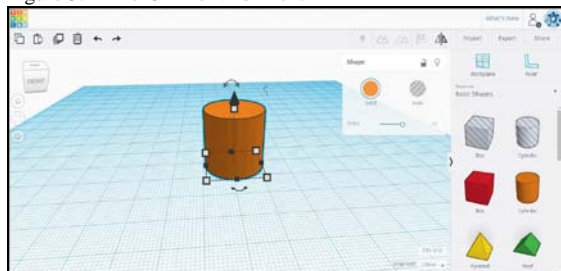
6 TinkerCAD

TinkerCAD is a product of Autodesk (AutoCAD). It is one of the simplest 3D programs that even first grade children can learn to use well. Yet it is not only for them. The software has a clear interface - it is based on creating a design using 3D shapes and solids from a prepared library and combining them (adding or removing shapes) to create the represented model. TinkerCAD is built on a web browser and is completely free. Teachers (or just students) can create an account and invite classmates via a connection code. It also allows students to access their designs outside of school and share their designs with the global TinkerCAD community. Gradually, as children's skills develop and their designs become more and more

complex, it can be interesting and beneficial for pupils to transfer models from TinkerCAD to the professional program Fusion 360 (from the same Autodesk development company). The resulting model that the student creates can be easily exported to STL format and downloaded for printing. TinkerCAD is therefore compatible with 3D printing.

Another nice feature of TinkerCAD is that it offers the Circuits feature. This allows you to design, work, build and understand the principles of electrical circuits. Or at least it can become an interesting didactic tool for pupils in the highest year of primary school. Pupils can design various circuits, program microcontrollers and incorporate electronics directly into their 3D designs.

Figure 3: TinkerCAD environment



Source: authors

7 SketchUp

SketchUp is one of the most widely used 3D drawing programs. It impresses with its simplicity and user-friendly interface. Unlike most CAD programs (such as AutoCAD), it works directly in 3D space. It finds its application not only among amateurs, but also in the world of architects, interior designers, furniture makers, model makers and anyone who needs to quickly prepare a 3D design or just capture an idea and sketch. Today there is a desktop version of SketchUp Pro and also a simplified online version of SketchUp Free. Even the Free version is quite sufficient in scope for pedagogical purposes beyond elementary school. The advantage of the online version, apart from its price, is that it is continuously updated, has support for the Trimble Connect cloud service - projects are stored directly on the web. This way, students can have their projects available at school, on their home computer, or show off their creations on any device that is equipped with a WebGL-enabled web browser. SketchUp's strengths are its wide range of Import and Export features. Models can be converted from AutoCAD, for example, or exported to a 3D printer.

The first version of the program was introduced in 2000 by the American company @Last Software. In the same year it won the Community Choice Award. SketchUp was presented as an easy-to-use 3D tool for creating 3D models with an intuitive user interface. The program gained great popularity due to the short time required to learn and understand the features. The next evolutionary step for SketchUp was the change of ownership in 2006. Google bought @Last Software and released a free downloadable version of "Google SketchUp" in addition to the commercial version. This already included the Google 3D Warehouse. Google 3D Warehouse is a huge repository of models made in SketchUp by users. The vast majority of models are available for free. In 2012, SketchUp was purchased by Trimble Navigation and released SketchUp Pro 2013. In parallel, SketchUp Make 2013 was introduced, which is completely free for non-commercial use. The latest version is the desktop version SketchUp Pro 2020 and the web browser version SketchUp Free.

Figure 4: SketchUp - using the 3D Warehouse library



Source: authors

8 3D modelling from the perspective of primary school pupils - a research probe

As mentioned in the previous text, there are a variety of tools on the market for implementing 3D modelling-focused learning. 3D modelling and printing fit into the concept of STEM/STEAM education (Wang et al., 2018). The aim of this concept is to create a better relationship with STEM subjects (science, technology, engineering and mathematics) in students so that an increasing percentage of graduates choose a career and professional life in this field. For this reason, this issue is also taught in some schools within the Olomouc region, which, in line with the modernisation of teaching in technical and computer science subjects, include the issue of 3D modelling and 3D printing in their teaching.

The contact with these schools occurs within the framework of joint cooperation within the Summer Schools of Computer Science or within the framework of the European-wide activity CodeWeek, which pupils and teachers of selected schools attend and which the author's workplace provides to schools and their pupils and teachers. Within the framework of this mutual cooperation, a request was made by these schools, a total of 8 primary schools within the Olomouc region, to carry out a joint research investigation that would map the benefits or negatives of the inclusion of 3D modelling and 3D printing from the perspective of the pupils of these schools. The contacted teachers therefore promised the necessary cooperation in making the necessary research tool, a structured questionnaire, available to their pupils. The research was carried out from September 2021 to November 2021 and during this period a total of 237 respondents - pupils of primary school level 2 - benefited from the research. This period was followed by the processing and evaluation of the responses.

As a research tool for data collection we chose an online questionnaire of our own design. This choice was based on the need to reach the pupils of the selected primary schools during the period of limited contact teaching caused by the pandemic situation of Covid-19. For this reason, we evaluated the use of an electronic questionnaire as the most appropriate form, because the questionnaire could be easily distributed, filled in by the respondents and evaluated electronically. In designing the questionnaire, consideration was given to adhering to the basic requirements and characteristics outlined by Chráska (2016, pp. 164-165). The questionnaire was distributed via email or the school's information system, which, in addition to the accompanying message text, also contained a link through which respondents could access the questionnaire. The questionnaire was anonymous, and it was used to elicit pupils' opinions or attitudes towards teaching focused on the use of 3D modelling software. The pupils of the selected primary schools were therefore able to fill in the questionnaire anonymously and thus record their opinions and attitudes on the individual questions. They could express their opinion by ticking YES or NO, according to their personal preferences or opinions. A description of the research sample is given in Table 1 below.

Tab. 1: Structure of the research sample

Gender	Number of respondents	Number of respondents in %
Boys	112	47.3%
Girls	125	52.7%
Total	237	100.0%

Source: authors

As the main method to evaluate the acquired research data, chi-square test (Chráska, 2016) was used to determine the dependence of the results on a certain significant characteristic of the group of respondents, which was gender. Basic descriptive statistics and their visualization using tables were used to determine the power of each group of respondents who answered in the same way. Statistica 14 statistical system was used for the calculation (Meloun, Militky, & Hill, 2017). In the following, some partial results of the conducted research investigation are presented, which aimed to find out the opinions and attitudes of the students of the selected schools towards the teaching focused on the use of 3D modelling software, and its real impact on the educational process in these schools.

9 Partial outputs of the implemented research probe

In the following, the outputs of the research investigation are presented in five separate areas. Each analysis involved the calculation of a contingency table, the calculation of percentages and the assessment of the dependence of the result on the gender of the respondents. For simplicity and clarity, all three analyses are included in one table.

The first area examined was whether students were interested in 3D modelling software. Thus, pupils were able to give their opinion on whether they found learning 3D modelling programs interesting and creating 3D computer models beneficial from their point of view. A summary of the results of their responses is demonstrated in Table 2 below.

Table 2: Interest in learning 3D modelling

Contingency table for: n = 237 Pearson chi-square: p = 0.00546 Are you interested in 3D modelling?			
Gender of respondents	Boys	Girls	Line totals
No - frequency	37	83	120
No - %	15.7%	34.8%	50.5%
Yes - frequency	54	63	117
Yes - %	22.8%	26.7%	49.5%
All groups - frequency	112	125	237
All groups - %	47.3%	52.7%	100.0%

Source: authors

According to the results shown in Table 2, it can be stated that almost half of the students of the selected primary schools, namely 49.5%, were interested in learning 3D modelling. Thus, the initial assumption that the inclusion of this educational content would be interesting and beneficial for the pupils was confirmed.

Furthermore, it can be stated that there is a statistically significant difference ($p=0.00546$) between the response rates of girls and boys. Boys were demonstrably more interested in 3D modelling than girls, which is a normal result and not out of line with the usual average, given the generally higher popularity of technically oriented activities among boys.

Another area investigated was whether pupils found learning 3D modelling difficult or more difficult than other technically oriented activities. Pupils were therefore able to give their opinion on whether they found teaching this subject more difficult than other subjects taught in technology or practical activities. A summary of the results of their answers is shown in Table 3 below.

Tab. 3: Level of subjective difficulty of learning 3D modelling

Contingency table for: n = 237 Pearson chi-square: p = 0.00061 Did you find learning 3D modelling difficult?			
Gender of respondents	Boys	Girls	Line totals
No - frequency	51	108	159
No - %	21.5%	45.5%	67.0%
Yes - frequency	40	38	78
Yes - %	17.1%	15.9%	33.0%
All groups - frequency	112	125	237
All groups - %	47.3%	52.7%	100.0%

Source: authors

According to the results shown in Table 3, it is quite obvious that the vast majority of primary school pupils (67.0% overall) do not find the teaching of 3D modelling difficult, or more difficult than other thematic units focused on technology or practical activities. This result indicates, among other things, that the general popularity of technically oriented subjects is high and that pupils therefore welcome other ways to enrich their learning, which was also confirmed in this case.

Furthermore, it can be noted that there is a statistically significant difference ($p=0.00061$) between the frequencies of girls' and boys' responses, where girls were statistically significantly more likely to welcome the inclusion of this learning content in their lessons because they found its difficulty lower.

The third area examined was whether students would welcome the opportunity to further their education in 3D modelling, both guided and independent. Pupils were therefore able to express their views on whether they found the subject so engaging and developmental that they would like to pursue it in the future. A summary of the results of their responses is demonstrated in Table 4 below.

Tab. 4: Interest in further use of 3D modelling

Contingency table for: n = 237 Pearson chi-square: p = 0.00135 Do you want to continue to pursue 3D modelling?			
Gender of respondents	Boys	Girls	Line totals
No - frequency	67	128	195
No - %	28.2%	54.2%	82.4%
Yes - frequency	24	18	42
Yes - %	10.0%	7.5%	17.6%
All groups - frequency	112	125	237
All groups - %	47.3%	52.7%	100.0%

Source: authors

According to the results shown in Table 4, it is clear that only less than one fifth of the pupils of the selected primary schools, namely 17.55%, would like to be further educated in 3D modelling. Although this result is in contradiction with the first analysis presented above regarding the interest in this learning, it can be explained by the fact that the general level of intentionality in education is currently lower and therefore further education is rejected from the pupils' point of view. Furthermore, it can be noted that there is a statistically significant difference ($p=0.00135$) between the response rates of girls and boys, with girls rejecting further education in 3D modelling more often than boys. This result is also not unusual and is related to the generally lower popularity of technically and science oriented subjects among girls.

The fifth, and final, area investigated here was whether the students would use the acquired 3D modelling competences in their future lives. This question was again related, albeit indirectly, to the further career orientation of primary school pupils and their interest in further work in technical sectors.

A summary of the results of their answers is demonstrated in Table 5 below.

Tab. 5: Interest in further use of 3D modelling

Contingency table for: n = 237 Pearson chi-square: p = 0.00565 Do you think that 3D modelling will be beneficial for your future life?			
Gender of respondents	Boys	Girls	Line totals
No - frequency	50	102	152
No - %	21.2%	43.0%	64.2%
Yes - frequency	42	43	85
Yes - %	17.5%	18.3%	35.8%
All groups - frequency	112	125	237
All groups - %	47.3%	52.7%	100.0%

Source: authors

According to the results found in Table 5, it is clear that the students of the selected primary schools understand the need for 3D modelling education, as almost 36% of them stated that they will use the outcomes of this education in their future life.

Although there is a statistically significant difference ($p=0.00565$) between the response frequencies of girls and boys, overall, both girls and boys think that the application of 3D modelling is not beneficial to their future life, so boys are significantly more likely to admit that 3D modelling will be beneficial to them.

10 Conclusion

The inclusion of 3D modelling and the subsequent 3D printing is an innovative way of using modern information and communication technologies in education. Its impact, as revealed by the research investigation described above, has positively influenced the formation of key learning activities for pupils in selected primary schools where such a focus is implemented. Thus, the teaching of 3D modelling to primary school pupils offers the opportunity to learn about and improve the issues of creating 3D drawings and to develop individual skills in a new way, including the opportunity to solve tasks in an engaging and independent way in relation to individual knowledge of working with technical means and digital technologies. All these competences together can contribute significantly to the wider adaptability of pupils in further education.

On the basis of the conducted research investigation, which aimed at exploring the current level of awareness and practical experience of pupils with 3D modelling, we can draw some conclusions. An important conclusion is the fact that 3D modelling is perceived positively by pupils interested in the subject. Although there are some gender differences, even at a statistically significant level, these cannot universally point to a lower interest of female primary school pupils in technical education, but only to a lower interest in the issue of 3D modelling. Here we must also draw attention to the fact that, with regard to the total number of female primary school pupils, this is certainly not a significantly representative research sample, but it does provide at least an indicative approximation of the issues under study.

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THE INTER-GENRE PHENOMENON OF THE CYCLE “PROGRAM OF WORKS” BY LEV RUBINSTEIN

^aEKATERINA ZHILENE, ^bOLGA BOGDANOVA, ^cANNA RYABCHIKOVA, ^dELIZAVETA VLASOVA

^a*St. Petersburg State Institute of Culture,
St. Petersburg, Dvortsovaya emb., 2, Russian Federation
email: ebibergan@yandex.ru*

^b*F.M. Dostoevsky Russian Christian Humanitarian Academy,
St. Petersburg, Fontanka River Emb., 15, Russian Federation
email: olgabogdanova03@mail.ru*

^c*A.I. Herzen Russian State Pedagogical University,
St. Petersburg, Moika River Emb., 48, Russian Federation
email: litredactor@list.ru*

^d*Russian National Library,
St. Petersburg, Sadovaya str., 18, Russian Federation
email: kealis@gmail.com*

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Abstract: The article is devoted to the analysis of Lev Rubinstein's early conceptual practices, in particular his cycle “Program of Works” (1975). The research is undertaken in order to comprehend the role of the cycle “Program of Works” in the formation of Rubinstein's poetic world at its early stage and to expose its influence on the theory and practice of “Moscow romantic conceptualism” (B. Groys). The authors of the article outline the dynamics of Rubinstein's experimental moves in his promotional texts 1970s-1980s and identify the inter-genre dominants of L. Rubinstein's literary text, formulate the principles of conceptualist strategies put forward and tested by the poet in those years.

Keywords: Rubinstein; conceptualism; “Program of Works”; genre; strategy.

1 Introduction

The relevance of the research topic is due to the fact that the work of Lev Rubinstein, poet-conceptualist, is becoming popular not only in Russia and the USA, but also around the world. Rubinstein's poetic creativity requires a deeper study.

2 Literature Review

The theoretical basis of the research was fundamental works on poetology (Trostnikov 1997, Novikov 2001), the peculiarities of inter-genre neoplasm, in particular, on the intersection of prose and poetry (Zhirmunsky 1979, 2001, Lotman 1972, 1973), on the history of the “Moscow romantic conceptualism” (Groys 1993, Epshtein 2019, Bobrinskaya 1998, Kazarina 2005). About conceptual verses in Rubinstein's work there is a detailed research of M. Lipovetsky (Lipovetsky 1997), M. Eisenberg (Aizenberg, 1997), O Bogdanova (Bogdanova 2004).

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 The beginning of L. Rubinstein's “program” project

According to the “Dictionary of Terms of the Moscow Conceptual School”, the concept of “The Program of Works” was introduced by Lev Rubinstein in 1975 to denote a set of artistic gestures of the author aimed at formalizing the creative process (Monastirsky 1999, 73). In other words, the poet's idea was close to what later came to be called a “conceptualist project” or a “conceptualist strategy”. These terms usually mean such artistic activity, the purpose of which is not the result, but the *observation* of the course of the creation of a text – a text as “an unfolded event, an instantaneous gesture or not limited by any framework of contemplation” (Bobrinskaya 1998, 11)

In our case, qualifying L. Rubinstein's “Program of Works” as a kind of cycle that outgrows the boundaries of the work of the same name, one should understand by this definition a number

of artistic texts of the poet united by a common theme, the figure of the Author and his attitudes. According to our concept, the cycle consists of nine promotional texts from 1975-1981: “Program of Works” (1975), “The Next Program” (1975), “Catalog of Comedy Innovations” (1976), “This is All” (1979), “Alphabetical Index of Poetry”, “Event without a Name” (1980), “From the beginning and to the end” (1981), “Thirty-five new Sheets”, “The Program of Joint Experiences” (1981).

Lev Rubinstein's project was initiated by a series of pre-notification documents of the same name with a cycle about the beginning of the development and implementation of the “Work Program-75”. It is presented in the Moscow Archive of New Art (MANI) and is not included in any collection of Rubinstein's poetry. The work consists of eight A4 typewritten sheets filled in between September and December 1975 and addressed to the “Circle of Interested Persons”. The concept of “Circle...” was introduced by Rubinstein as a replacement for such a category that is not applicable to the situation of samizdat, as the public or the readership. Having no opportunity, and often no intention to publish, underground writers exchanged works in a narrow cultural space that was not and could not be open to the mass reader. Orientation to a certain group of listeners, and at that time they were researchers, specialists in the humanities and artists in the broad sense of the word, assumed a change in the passive role of the perceiving subject. In contrast to the didactic, propagandistic nature of official culture, conceptualism abolished the ideological direction in art and provoked public participation in the creative act. The appeal to the Circle of Interested persons in the “Related Information”, namely, such a subtitle was worn by all eight sheets of Rubinstein, was a necessary condition for the existence of the “Program”. So, “Related Information-4” calls on members of the Circle to make a number of independent proposals that formally and actually answer the question “What to do?”. The recipient is assured that part of the proposals will be included in the “Work Program”. Provocation of a retaliatory remark by a person from among the public pushes the boundaries of the text and makes its content permanently changing.

Rubinstein demonstrates the approach to understanding a work of art that made conceptualism a unique phenomenon of the late twentieth century: “...instead of paints and clay, meter and rhyme, instead of notes and musical sounds, the work of consciousness, the very process of thinking and understanding turns out to be the material of art” (Bobrinskaya 1998, 14). This revealed the intention of the new art to smear, characteristic of the artistic system of Rubinstein and fellow conceptualists: the text is referred to by the poet as the “Circle of attention distribution”, the radius of which is subjected to a methodical revision. Such a nomination is as vague and streamlined as possible, which undermines the very concept of a “term” – a word that is an exact designation of a certain object. However, the act of “distributing attention”, that is, simple observation, cannot be finite, and as the gaze glides over the objects of reality, lingering for a second on one of them, so the text captures only small fragments of discourses. The ability of a work of art to merge with life becomes essential. Its actualization is due not so much to the diversity of the surrounding world as to the genre dominant of the work, the work program, that is, a long-term plan, an application for future activities, the deadline for which is postponed with each new “Related information”. „The text becomes the object of experimental manipulations, turning into an object, then into a process” (Eisenberg 1997, 144), which does not allow it to be unconditionally attributed to the sphere of literature. For example, the use of anaphoric repetition – the call “Attention!”, which opens each new sheet of messages – states more compliance with the canon of notification documents than an artistic technique, since the task of these appeals is to focus the reader's perception and activate enhanced peering.

The focus on the reader's opinion problematizes another fundamental issue of conceptual art, namely authorship. Due to the fact that the sheets of "Information" were formed as the reader's judgments arrived, the modification of the signature at the end of the messages (since November 1975, the addressees are the Authors) emphasizes the collective nature of the "Program of Works". The communicative function of the text comes to the fore, which is absolutized in the last message of the "Program", to which was attached a questionnaire with a number of questions clarifying the perception and evaluation of the principles of work. The author's text smoothly passes into the reader's text, the work of art – into a commentary to it.

5 "That's All" as an example of promotional poetry

An example of Rubinstein's promotional poetry "This is All" (1981) is indicative. The text consists of eight sheets with answers to the question "What is *all this?*" arranged in alphabetical order with empty columns for the reader to fill in. The author is not revealed in the text, he does not give instructions, does not require an answer, but instead there are such stable grammatical constructions and comparative phrases that cause an automatic response in the reader's mind. The text, dialogical in its essence, appeals to the linguistic experience, linguistic associations of the subject of reading, thus exposing its performative essence and the deep problem of the constraint of thinking by language patterns. So, to the phrase "It's all incompatible (with what?)" the reader's consciousness most often gives out the commonly used cliché "incompatible with life" (Rubinstein 1981, 85). A long search of options as an attempt to try on specific descriptions to one abstract object ends with a series of empty lines and the final phrase "that's all", which summarizes the enumeration and at the same time marks the end of the narrative. In the situation of speech generation, when the language is not able to speak out, plunging into speech formulas, a space of emptiness is formed. Fixing this void, as well as "testing its strength" (Eisenberg 1997, 14), is the main engine of Rubinstein's early conceptual experience.

6 Continuation of the project in the "Next program"

The logical development of the declared project was the "Next Program", dated December 1975. Moreover, the Author's decisions about the title of the text, its inclusion in the "Program of Works", as well as dedication to the German romantic Novalis arise and are approved in the course of reading. In other words, the process of creating a work of art is actualized in front of readers. The author notifies the Circle of interested persons about the progress of the work, choosing an increasingly mobile way of notification – reading information from library cards, the form of which dictates the amount of content. The volume of the text cannot be more than a few short lines.

The content of the "Next Program" resembles the Author's comment on the creative process. His arguments are built around the theses and concepts embedded in the work and thus inevitably postpone the moment of the reader's meeting with the proto-text. In parallel with this, the involvement of the perceiving subject in the event is provoked. Starting from the thirty-eighth card, the Author "finds it possible to listen to a number of passing remarks" about his text, which is still in the process of writing. The pause separating this fragment from the next one seems to give the reader the floor. And indeed, on the next card, "The author expresses his agreement or disagreement with a number of comments" (Rubinstein 2000, 19). Moreover, this uncertainty turns out to be a universal reaction of the author to possible replicas of the recipients.

In Rubinstein's "programs" the figure of the Author is rather phantom and indefinite. The author acts here both as a reasoner hero and as an initiator of a dialogue with the reader's consciousness. Therefore, all the remarks up to a certain point are perceived as a product of the real creator Lev Rubinstein. When the reader catches the idea of the work and asserts his knowledge of the further course of action, the card file transforms the rules of the game. From the 48th card, the text of

the "Next Program" is stratified into two levels: messages about the Author's actions-intentions are now accompanied by direct speech duplicating the situation being represented. For example: "Number forty-nine, where the Author asks to wait for him for one or two minutes. — That's what it says: *Wait for me...*" (Rubinstein 2000, 20). It is significant that in these fragments the replicas perform a purely illustrative function: quotes reinforce that has been said, but do not make semantic adjustments to it.

Meanwhile, from a compositional point of view, these inserts play the role of "small dormer windows" from which the echo of another life is heard. The intrusion of the Author's voice forces us to rethink the above messages, which were made as if on behalf of the Author – that is, with the appearance of the reference text, it turns out that the Author was silent throughout the work. An imperceptible hint, a hint at the true state of things is given in the twenty-seventh fragment, where "The Author responds with silence to quite possible accusations of the uncertainty of the author's position" (Rubinstein 2000, 17).

Such a game with the verbal design of silence, permeating all the work of the conceptualist Rubinstein, finds its most vivid expression in the early filing system. In fact, we have before us that model of a literary conceptual work in which "the reader reads and the author is silent" (Groys 1993, 265). In the conditions of the creator's inaction, the Text itself is endowed with a creative function, and the role of the Author is consistently averaged and even annihilated (recall the "death of the author" by R. Barth and M. Foucault).

This alignment of forces becomes apparent only by the end, but is already set in the first line. The text, "speaking for itself" (Rubinstein 2000, 15), autonomous from the category of authorship, develops independently of the will of the Author, who soon leaves the forefront of the "Program" and "does not take any part in it" (Rubinstein 2000, 22). The only sign of the Author's existence is his voice, sounding on nine cards out of seventy-nine and uttering such meaningless phrases as "I don't know", "Maybe", "I'm not comfortable with something", etc. It seems that these phrases have no direct relation to the declared "Next program". However, the apparent discrepancy dissipates if you pay attention to the remarks with the participation of the Author – reservations to what has been said prevail here, doubts about the ability to create a work of art, uncertainty about the right approach to the craft of writing. In other words, the real, hidden, subtext theme of the "Program" is the torment of creativity.

7 The role of gesture in the "Catalogue of comedic innovations"

Indecision in any gesture, the relativity of any position, the inexpressibility of emotional experiences clearly problematized in the "Catalogue of Comedic Innovations" (1976). "Romantic", from the point of view of the analyst and theorist of conceptualism B. Groys, this text makes utopianness of its postulates. "You can avoid fatal stupor if you thoroughly assimilate the principle of comedy", "You can not resist nature, crying out for leisure and inaction", "You can assume that what started with, will end with that", etc. (Groys 1993, 265). The list of possibilities of the game turns out to be extremely far from the empirical world, the recipient is offered a number of ideas, the embodiment of which is doubtful, and the content is unclear. "The text is both impenetrable and transparent: it does not require interpretation" (Groys 1993, 266) because of its aim in itself, and therefore it is here that the organics of Rubinstein's catalog genre manifest themselves more vividly than in other works of the cycle. Attention is focused not on the meaning of what is being read, but on the reading process itself, on the mechanics of flipping through the cards. "Hermeneutics has been replaced by a reading algorithm" (Groys 1993, 266), methodical and meditative in its essence, the alternation of the deck resembles the flow of sand in an hourglass. This metaphor is familiar from the performance of Collective Actions by Andrei Monastirsky "Time of Action", the essence of which was reduced to hours of pulling the rope from the opposite end of the

field to the audience. Despite the difference in the dates of the creation of the "Catalog" and the mentioned action (Rubinstein's card file anticipated the production of the group), both works operate with the compositional technique of "empty action" or, correcting this concept in relation to Rubinstein's "Catalog of Comedic Innovations", "empty reading".

It is necessary, however, to distinguish between the motives of emptiness and absence in Rubinstein. Their fundamental difference is easily illustrated by the example of the texts "This is all" and "Thirty-five new sheets". The first work reveals the problem of the inconsistency of the description with the subject, the loss of connection between the sign and the content, the inconsistency of language codes that only outline the emptiness, not being able to put it into words. Another text, "Thirty-five new Sheets", is a kind of "album" of sketches and ideas, notes on the margins of blank pages. Externally, the text is mounted artlessly: each of the thirty-five sheets has a number and a title ("Sheet 1", "Sheet 2", "Sheet 3", etc.), each has its own footnote with a page comment (for example: "Something must be written here", Rubinstein 2000, 243). "The purpose of the comment is to reveal what the Author thinks in the clear space between the title and the horizontal line that separates the space of the 'main text' from the footnote space, which is essentially the 'zero' text" (Pavlovets 2010, 17). The absence of signs and images is a negative technique, a continuation of the conceptual game, which was reflected in the painting of Rubinstein's predecessors, in particular the conceptual artists I. Kabakov and V. Pivovarov. The recipient's attention is shifted from the center to the periphery of the sheet, from the content to the note to it, since it is in the footnotes that the dramaturgy of the work is born, focused on the disappearance of categories not only of the object, but also of its creator. Examples of the Author's capitulation to the creative power of the Text were given above, but the conflict of the work lies in its final loss or, to use a post-structuralist term, in the same "death of the author".

On twenty-seven fragments, footnotes play the role of a reminder of an unfulfilled plan, are reduced to recording working moments or serve as a guide to action (primarily on the part of the reader – he is encouraged to fill out the page). But the function of comments changes dramatically with the appearance of the Author's name in them. "Sheet 27. I must remind you in a very definite way about the Author" (Rubinstein 2000, 256). "Sheet 28. Must constantly lie on the table, reminding of the Author" (Rubinstein 2000, 257). "Sheet 31. Must always be somewhere nearby and be shown to friends as a reminder of the Author" (Rubinstein 2000, 260).

A blank sheet, outwardly no different from many of the same, serves as a "representation of the unrepresentable", and footnotes acquire the meaning of a memorial word, a funeral reminder of the Author's former existence, which is replaced by voices, excerpts of statements: "It should be written here: *Recognition of individual merits is already something...*" (Rubinstein 2000, 244). "It should be written here: *A phrase uttered sleepily, more than the volatile significance of which...*" (Rubinstein 2000, 245). "It should be written here: *Is it really allowed to know how all this will end? What are you, by God...*" (Rubinstein 2000, 247). The invasion of other heterogeneous discourses finally levels the category of the Author, forming a situation of "immersion in a certain style or discourse until complete identification with them (as they used to say: the author dies in the text)" (Monastirsky 1999, 192), characteristic of Rubinstein's mature poems.

8 "Event without a name" as a text of collective actions

In 1980, Rubinstein created the "Event without a Name", a text that fully corresponds to the strategies of collective actions. Its plot – a gradual increase in expectation due to notifications of impending action – is based on the reception of waiting without getting a result. The anonymity of the event surrounds it with an aura of mystery, that is, it distinguishes it from other everyday incidents. However, at the same time, another nature emerges in it. The abstract nature of the upcoming action makes it universal,

that is, it allows you to apply it to any phenomenon. The action that had the features of "personalization" loses its identity. The declaration of an event creates the impression that it has begun, while textual information refutes premonitions, pushing the beginning indefinitely: "Absolutely impossible", "Absolutely impossible", "Impossible", "Maybe someday", etc.

Modeling in Rubinstein's text of "extremely compressed, almost indistinguishable action in the surrounding flow of life" (Bobrinskaya 1998, 13). Provoking reflection on it is the reference point of early creativity of "Collective Actions". The desire to record all the stages of the process, namely the origin, development and resolution of the event, was manifested in their activities at the first "Appearance" action organized with the participation of Rubinstein. This strategy was embodied by the poet in the catalog poem "Program of Works". It is easy to notice that most of the catalog texts of the Rubinstein cycle vary one of the three main techniques of spatial "Collective Actions": trick, substitution and provocation. The visual is transposed into the verbal.

Indeed, the plot of "An Event without a Name" boils down to an imitation of an event and an increase in emotional tension. The event itself is enclosed in the empirical field by a single phrase "Here!", followed by the final chords: "That's it". According to A. Monastirsky, "what happened was not what we expected, not some specific event opposed to us, but the expectation itself was accomplished and happened" (Monastirsky 1999, 23).

9 "Program of Joint Experiences" as a performance format

Form of performance was directly used Rubinstein in 1981, during the presentation of the text of the "Program of Joint Experiences". In contrast to the usual manner of reading poems, when the author recites them aloud, addressing the public, this text assumes an inverse scheme. Rubinstein: "The only spectator of this performance is the author himself. Because I'm watching these leaves go, and at every given moment, every person is reading something else" (Rubinstein 2010).

The inscription on the title card – "After reading it is passed from hand to hand" – explains the "rules of the game" and at the same time chaoticizes all organizing connections. Viewers become active subjects of action, now they are not just watching a one-man show with flipping through cards, but become participants or, more appropriately, actors of a spontaneous performance. However, the apparent spontaneity hides behind a rigid framework of the promotional genre.

Among the para-theatrical forms of contemporary art, it is customary to separate happening and performance. Their difference lies in the degree of thoughtfulness of the script and the role of the artist, who in the case of happening does not have full control over the action, entrusting its development to the audience. Improvisation is the main component of this form. But it is not represented in the performance, where the organizer always calculates the possible actions of the participants and tries to direct them in accordance with a pre-conceived plan. According to the differentiation of the two types of promotional activities, Rubinstein's "Program of Joint Experiences" should be recognized as a literary performance aimed not at overcoming the boundaries between the artist and the viewer, at equalizing their roles, but at changing the poles in the dumbbell scheme.

Thus, the critic V. Kuritsyn noted that the reading of the "Program of Joint Experiences" in most cases is accompanied by the remarks of the audience-participants, "who, passing cards to each other, enter into a kind of language game, fill the space of the process" with their voices (Kuritsyn 1995, 330). As a result, the sounding speech of the public is embedded in the text, interacts with intra-textual discourses and leads to the creation of multilevel polyphony, a living polylogue that levels the line between art and life.

The development of Rubinstein's game with the redistribution of roles was the "Program of Joint Experiences No. 2", designed

“for a different reading sequence randomly chosen by readers” (Ulanov 1996, 13). Despite the fact that this experiment has not been continued and the vast majority of the catalog texts remain numbered and structurally ordered, the “Program of Joint Experiences” in its two versions should be recognized as the quintessence of Rubinstein’s early work. It was here that the author achieved the maximum fusion between the “given moment” as a plot unit of the text and the plot “given moment” of the reading process, realizing the grandiose idea of conceptualism – to present “life as reading, as existence in the impossible space of a literary language” (Groys 1993, 265).

10 Conclusion

Summing up, it should be noted that the representation of the process, whether it is the act of creating a work, waiting for an event or fixing the process of perception of a given moment, are common terms and a cross-cutting theme of the works of Rubinstein’s conditional cycle “Program of Works”. The attention to performative forms of art inherent in the poet in the “pre-program” period was reflected in the creation of “a very special poetics”, which is based on the idea that “the description of the book ... in some sense, this book can replace” (Rubinstein 1999, 77). The result of such “artistic environmentalism” was texts on cards, an inter-genre and superliterary phenomenon that incorporates all the components of the communicative triad “author – text – reader”. At the same time, it is evolutionarily important that the card file – the corporate style of Rubinstein’s creativity as a whole – at an early stage of its development gravitated towards the form and structure of performance. Not only the specifics of the method of presentation of texts, but also the motivic complex, the system of artistic images, the author’s attitudes brought Lev Rubinstein’s works closer to the productions of A. Monastirsky’s “Collective Actions”, reflected the general principles of structuring – in a spatial text and a literary text.

11. Prospects for further research

Concluding the analysis of Rubinstein’s early conceptual texts, we can conclude that his practices contained the foundations of the theoretical base of the conceptualists, which were later formalized in the form of a declaration of “Moscow conceptualism”. In the future, it is necessary to analyze not only the later experiments of Rubinstein himself, but also to trace his influence on the formation of literary conceptualism of other representatives of this trend in the 1970s and 1980s.

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Secondary Paper Section: AJ

REGIONAL DEVELOPMENT IN CROSS BORDER AREAS OF SLOVAKIA IN NEW PROGRAMME PERIOD OF THE EU

^aLÍVIA BOTT DOMONKOS, ^bRENÉ PAWERA, ^cMARIÁN ŠUPLATA, ^dSABINA RÝZKOVÁ

Comenius University, Faculty of Management, Department of International Management, Odbojárov 10

P.O.BOX 95, 820 05 Bratislava 25

email: ^adomonkosova1@uniba.sk, ^brene.pawera@fm.uniba.sk, ^cmarian.suplata@fm.uniba.sk, ^dryzkova5@uniba.sk

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Abstract: This article focuses on the cross border rural areas located in the suburban zone of big agglomerations in border regions of Hungary and Slovakia and analyses their regional development possibilities via INTERREG HU SK new programme period projects. Special attention is devoted to demographic processes and phenomena related to these facts pandemic caused. Besides generally acceptable statistical data represents other data collected via field research in communities representing cross-border project expectation survey. It focuses on socio-economic effects of cross-border, analyses its impact on society of suburban inhabitants in Slovakia. There is a comparison between cross-border survey about the rural life standards before and after 2020 to predict current trends influenced by pandemic. Added value can be the results of measuring gap in economic and demographic development in the cross-border regions mainly between Hungary and Slovakia after COVID-19 pandemic in the era of new programme period of the EU 2021-2027 with wide potential of INTERREG HU SK cross-border project developments through innovation.

Keywords: regional development, project impact, new programme period, cross-border policy, innovation

1 Introduction

The choice of research topic is justified since cross-border agglomeration, which is a common phenomenon of current globalization, is multifaceted and highly relevant today and it got new measure under INTERREG programmes, from this we will be concentrating on INTERREG HU SK (Hungarian-Slovak interregional cooperation) as the longest border of the suburbia of Bratislava has impact on the Hungarian border region.

Interreg was developed as a Community Initiative in with a budget of just 1 billion EUR covering exclusively cross-border cooperation in 1990. Later, Interreg has been extended to transnational and interregional cooperation. For 2014-2020 European Territorial Cooperation is one of the two goals of Cohesion Policy besides investment for Growth and Jobs. Over the years Interreg has become the key instrument of the European Union to support cooperation between partners across borders. The aim: to tackle common challenges together and find shared solutions - whether in the field of health, research and education, transport or sustainable energy. Interreg programmes are funded by the European Regional Development Fund to support the harmonious development of the European Union's territory at different levels.¹

The choice of research topic is justified since cross-border agglomeration, which is a common phenomenon of current globalization, is multifaceted and highly relevant today and it got new measure under INTERREG programmes, from this we will be concentrating on INTERREG HU SK (Hungarian-Slovak interregional cooperation) as the longest border of the suburbia of Bratislava has impact on the Hungarian border region.

In 2007, following the successful implementation of the INTERREG Community initiative (1990-2006), European Territorial Cooperation, also known as INTERREG, became one of the main goals of EU Cohesion Policy. Consequently, the European Commission highly appreciates all sorts of studies and analyses that concentrate on assessing the implementation of INTERREG programmes, encompassing all three strands: cross-border (INTERREG A), transnational (INTERREG B), and

interregional (INTERREG C). Increasingly popular mechanisms driving the economic and social development of European border and cross-border regions are cross-border development strategies. Such a strategic framework provides a more integrated vision, with prospects for the future, and defines the objectives and development priorities for the region. Moreover, this type of framework allows for planned and integrated action, instead of ad hoc and uncoordinated intervention. In general, cross-border strategies constitute a natural development beyond dealing with daily problems and provide a very useful framework to develop cross-border policies and joint funding programs that are multi-annual and have several financial sources.²

During the 2014-2020 period, the Interreg programs funded a wide range of projects aimed at promoting territorial cooperation and regional development within the European Union. These projects covered various thematic areas and addressed challenges such as economic growth, innovation, environmental sustainability, social inclusion, and cross-border cooperation. The funded projects fostered collaboration among different regions, countries, and stakeholders, facilitating the exchange of knowledge, best practices, and experiences. They aimed to overcome territorial barriers and promote the harmonious development of border regions. The funded projects varied in nature and scope. Some focused on promoting entrepreneurship and supporting small and medium-sized enterprises (SMEs) through cross-border networks and business development initiatives. Others targeted environmental protection and sustainable resource management, promoting initiatives such as renewable energy, waste management, and ecosystem conservation. Furthermore, the Interreg programs funded projects in fields like research and innovation, education and training, cultural heritage preservation, social inclusion, and healthcare cooperation. These projects aimed to enhance collaboration and exchange of expertise across borders, driving regional development and fostering a sense of shared identity and cooperation among participating regions. Overall, the funded projects under the Interreg 2014-2020 programs played a crucial role in strengthening European territorial cooperation, addressing common challenges, and contributing to the sustainable and balanced development of the participating regions.³

In the new programming period 2021-2027, it is planned to continue INTERREG programmes to promote European territorial cooperation. These programmes will focus on a variety of areas, including crossing borders, cooperation between regions and strengthening convergence and competitiveness. The main priorities and actions of the new INTERREG period are not yet known as the programmes and principles are still being developed. Planning for the new INTERREG period is usually led at the level of the European Commission and national/regional administrations. Moving forward to the new programme period, it is expected that the relationship between changing socio-economic needs and legal obstacles, as well as the promotion of a positive attitude towards cross-border living, will continue to be a priority. The new Interreg programmes (2021-2027) will build upon the achievements of the previous period and further enhance cooperation and integration among border regions. The Interreg 2021-2027 program would like to prioritize strategic objectives such as enhancing competitiveness, supporting the green transition, promoting digitalization, fostering social inclusion, and improving the quality of life in participating regions.⁴

² Medeiros, E.: European Territorial Cooperation: Theoretical and empirical approaches to the process and impacts of cross-border and transnational cooperation in Europe. Vol. 54. Cham: Springer, 2018. 269 p. <https://doi.org/10.1080/00343404.2019.1672937>

³ Interreg Europe: Interreg Europe Programme Manual, 2021. https://www.interreg.eu/sites/default/files/2022-01/Interreg_Europe_Programme_manual.pdf

⁴ Interreg Europe. Programme Manual, 2022. https://www.interreg.eu/sites/default/files/2023-02/IR-E_programme_manual_annexes.pdf

¹ European Commission, DG Region Urban Policy, 2023. https://commission.europa.eu/about-european-commission/departments-and-executive-agencies/regional-and-urban-policy_en

The aim of the project HUSK (Hungary-Slovakia Cross-border Co-operation Programme) is to provide the widest scale of services to Slovak entrepreneurs, that will help them to establish new business cooperation with partners on the Hungarian side.⁵

Interreg programmes have an indirect impact on urbanization and related land-use practices and address some of the big challenges of sustainable development (such as issues related to environmental protection or encouraging sustainable development). The URBACT III expressed support for polycentric urban structures, small- and medium-sized cities, and urban-rural linkages, explicitly calling for coordinated policies for urban renewal and control of urban sprawl. Furthermore, as the overall aim of the programme is to support integrated sustainable urban development, various projects implemented under its funding are expected to contribute in varied ways towards sustainable urbanization, inter alia integrating transport planning and land-use planning, promoting brownfield redevelopment, green infrastructure, urban soil management, etc.⁶

The Added Value from ETC (European Territorial Co-operation) Programmes:

- a European added value arising from the contribution of CBC to the promotion of peace, freedom, security and the observance of human rights;
- a political added value involving the development of European integration, subsidiarity, partnership, and cohesion;
- an institutional added value, involving citizens and authorities, guaranteeing knowledge about the neighbor and long term cooperation;
- an economic added value, mobilising the endogenous potential of cross-border regions, the participation of all economic players, the opening of the labour market and the harmonisation of qualifications, among other things;
- a sociocultural added value reflected in the dissemination of knowledge about the neighbor, its culture, and an extensive knowledge of its language. Only if sociocultural cooperation takes place, can a workable cross-border environment for business, trade and services be established.⁷

EU new programming period is characterised by the Slovak Plan of Innovation. (Plan of innovation, Plán obnovy, 2023)⁸ EU Commission devotes new regional strategy for cross-border territories, also influenced by local and microregional policies, based on cohesion policy. (European Commission, DG Region Urban Policy, 2023) Cross-border strategy in influences by Innovation, programmes, topics as the long version of Interreg programme states.⁹ The consequences of the coronavirus pandemic will have a fundamental impact on the economic, political and social spheres of our society in cross border region and influence further regional development and innovation in the field of projects. The coronavirus pandemic has revealed specific and general problems of the EU, Slovakia and cross-border region and the global society.

Impacts and innovation growth on long-unseen challenge, burdening the entire social system with a variety of difficulties from problems associated with physical diseases to problems associated with social and economic development. Consequences are unknown and unpredictable, the likely economic, political, and social consequences of the current pandemic are already demonstrating their essence.

More and more scientists and experts are expressing the opinion that humanity has entered a new stage in the formation of the world order. What will become a society of cross-border after pandemic in new programme period? How will socio-economic disparities develop in 2021-2027? How will bilateral and cross-border society react and arise in terms of project awareness and willingness to participate?

2 Literature review

In terms of Hungarian and Slovak cross border region it is easy to find two other dimensions of regional development, one is suburbanisation and the other is periphery and core theory. Concepts and definitions of the suburbanisation process vary in the literature. Suburbanisation is most often understood as the process of relocation of populations and institutions from the inner city to the periphery of the city and to the suburban zone. In accordance with the concept of inner-city urbanisation as defined by us, this process can be characterised as an increase in the degree of urbanisation of areas located on the outskirts of the city and in the suburban zone.

Ratzel's theory (1896), developed alongside Friedman (1969 and 1974), states that centres (cores) are regions that are characterized by very significant development potential and the ability to generate innovation, while peripheries are stagnant and very slowly developing areas that depend on centers. Therefore, peripheries are not only geographical peripheries, but also economic peripheries. Peripheries and suburban zones are complex spaces that do not have universal definitions. An attempt to define suburban areas in space was made by Burgess (1925),¹⁰ who developed the peripheral-concentric model. The essence of this model is the theory that the strength of the economy is concentrated in the centers and the peripheries show inferior signs of development. The periphery boundaries can therefore be defined not only geographically but also economically.

Hoyt (1939)¹¹ argued that urban space does not form concentric spheres but expands along major roadways. Most authors agree that there is a very strong link between rural and urban centers. In the literature we find different opinions on whether the tendencies of suburbanisation of the surroundings of our cities coincide with the tendencies in Western Europe (Tímár, Váradi 2000).¹² In general, the tendencies of urban development are similar, to some extent they are also characterized by peculiarities typical for Central Europe, which result from the historical development of the given area, from the socio-economic development of the cities or from its temporal shift (Enyedi 1988, Rechnitzer 1994).¹³ Another but no less interesting question in the case of Hungarian authors is precisely in what way the suburbanization of rural towns within Hungary differs from the processes in the vicinity of Budapest and vice versa.

The driving forces are the same, but the emerging problems are in many ways similar to those in other countries. As COVID-19 developed holiday homes in rural areas of Bratislava, the rural environment has been given a more varied image through suburbanization, especially in the last year of pandemic. Such research originates back to the principal idea that a certain geographical space, a settlement, or a landscape, means much more than just a simple element of space. The motivation for moving from big cities to rural suburban regions can be currently twofold, the regular suburbanisation process and the pandemic caused changes.

⁵ BIC Bratislava, Projects. <https://www.bic.sk/en/projects>

⁶ Reitel, B., Wassenberg, B., Peyrony, J. (2018). The INTERREG Experience in Bridging European Territories. A 30-Year Summary. In: Medeiros, E. (eds) European Territorial Cooperation. The Urban Book Series. Springer, Cham. https://doi.org/10.1007/978-3-319-74887-0_2

⁷ Guillermo-Ramirez, M. (2018). The Added Value of European Territorial Cooperation. Drawing from Case Studies. In: Medeiros, E. (eds) European Territorial Cooperation. The Urban Book Series. Springer, Cham. https://doi.org/10.1007/978-3-319-74887-0_3

⁸ Plan of Innovation, Plán obnovy <https://www.planobnovy.sk>

⁹ Interreg Programme Document 2021–2027 <https://www.skhu.eu/programme/interreg-husk-2021-2027>

¹⁰ Burgess, E. (1925) The Growth of the City An Introduction to a Research Project. In Park, R.E., Burgess, E.W. and McKenzie, R.D., Eds.

¹¹ Hoyt, H. (1939): The structure and growth of residential neighborhoods in American cities. Washington, DC: Federal Housing Administration

¹² Váradi Timár, J. (1992) The Main Features of Suburbanization in the Great Hungarian Plain. Landscape and Urban Planning 22 (2-4): 177-187.

¹³ Enyedi Rechnitzer, J. (2010) „Enyedi, a regionális tudomány alapítója”. Tér és Társadalom, 24(3), o. 9–10. doi: 10.17649/TET.24.3.1828. .

From economic point of view, the negative impact of the coronavirus epidemic is measured not only by the number of people infected and sick, but also by the economic consequences that have arisen in connection with it. Thus, the coronavirus affected all global markets, which led to a drop in stock prices and bond yields. In addition, this epidemic has led large institutions and banks to lower their forecasts for global economic growth. However, the European Commission (further as EC) has lowered its forecast for the global economic downturn due to the COVID-19 pandemic in 2020 to 3.8%.¹⁴

The EC also lowered expectations of economic recovery in 2021 to 4.7%. In the spring, a decline of 2.9% in 2020 and a subsequent recovery of 5% in 2021 were forecast.¹⁵

The epidemic had a negative impact on the service sector, retail trade, tourism, and brought sharp restrictions on various types of transportation, which could not but affect the economics and business in many countries. The consumer market has been significantly reduced.¹⁶

In general, on the outskirts and periphery of a big city as Bratislava outlines processes that take place in the so-called rural-urban fringes. Regarding functionality, there is a debate as to whether suburbanization (building a new city) or urban sprawl is taking place. Regardless, the results are newly established residential districts around the city.¹⁷

Indicators of the process are migration growth, housing and housing stock. These are both quantitative and qualitative increases, moreover the consequences are better in the field of technical infrastructure, higher land and real estate prices, changes in the structure of society segregation of houses.

Suburban growth creates a population between the central city and the suburbs, leading to changes in the demographic and sociological indicators of the suburban population (socio-demographic approach) and the spatial structure of the suburbs. New constructions in the suburban environment¹⁸ can be defined as modern uninformed residential areas that are ready for family homes or individual construction on plots offered by an investor or massed new development areas¹⁹ with possible individual house construction on vacant plots as part of existing installations.²⁰

Survey on satisfaction with inter-fraud suburbanization and reducing of urban vulnerability in other perspective²¹ examined satisfaction with the services and institutions provided by the municipalities, majority of the residents do not to their satisfaction. Based on previous research this predominantly complaining layer for their villages is mainly lacked by services like health care provider, post office, pharmacy as factor for regional differentiation.²²

Lack of schools in cities arose during COVID-19 as home-schooling was provided as only option. In the survey group as well, the responses of residents here are clear complaints in this area. Bratislava preference is more significant because the correlation is high. As a result of research, it was planned to achieve that by evaluating the present situation in the most

“suburbanized” localities get questions and answers with the intention of meeting the current needs of the residents make recommendations to decision-makers during the survey.²³

In micro-region of Bratislava - Győr suburbia all the answers should be taken into account when defining long-term plans, it is important that the residents themselves can help to create a regional image for suburban development.²⁴ Cross-border suburbanization is one an extremely delicate process of spatial development with poor and less bad solutions are born because of the opportunities.²⁵ Prices in the housing market and the surrounding countries all offer contribute to the decision and further to the number of implemented projects in the calls of 20214-2020 Interreg HU SK.²⁶

3 Research problems and goal

Through the COVID-19 virus crisis and the high preventive measures that accompanied it and based on the massive use of social networks, it is imperative for each user to adopt positive social behaviour such as sympathy, sharing and cooperation in order to overcome this crisis. In addition, the individual should highly prove being a valid citizen by carrying out the duties of citizenship through this change of permanent address from the real place of origin to the suburbia.

The research identified its problem as studying the role of suburbias and pandemic in particular in promoting changed positive behaviour to deal with the COVID-19 pandemic as a crisis experienced by all members of society and its institutions amongst a sample of inhabitants changing permanent addresses, which is an economic, social and identity related issue. This shift of official seat usually comes with taxation, social dependence and belonging status to the land and region in border land.

Coming back to INTERREG HU SK options in new programme era, the programme manual focuses on the impact of pandemic and selected social contributions in terms of Priority Axis SO.

The importance of this article stems from the importance of the topic itself as it deals with, both the positive behaviour and the pandemic and social -economic crisis and their related variables. In fact, they got great interest and care by specialists, especially with the unbridled growth of project interest and project brief change from the capital toward the suburbia, smaller towns and periphery, focusing on this global pandemic, which has affected profoundly all economic and social joints of life.

The importance of the study is also determined from an applied point of view in transforming its results to a set of recommendations. These conclusions may contribute to enlightening those interested in this crisis, from various social, economic and political institutions to the reality of positive behaviour through the change to enhance its role in a better way through programmes designed to face this crisis.

Accordingly, this study set its objectives as follows:

- *Identifying the relationship between changing socio-economic needs, as legal obstacles, eligible applicants, public, academic and business sector and their interest, as well as promoting positive attitude to cross – border living during the old programme period*
- *Interpreting the differences in the level of changed socio-economic behavior through suburbanisation during the COVID19 crisis according to the variables of before and after new programme period (2020 and 2023)*

¹⁴ European Commission Official Webpage of Strategy Development (2022) Strategy and Policy COVID 19 https://commission.europa.eu/strategy-and-policy_en

¹⁵ Burns, Yu. (2020). The European Commission has lowered its forecast for a global economic downturn in 2020. November 5, 2020. European Commission

¹⁶ Šveda, M. (2011). Suburbanizácia v zázemí Bratislavy z hľadiska analýzy zmien krajiny. In: Geographical Journal ISSN 0016-7193.

¹⁷ Bouregard, RA (2006): When America Became Suburban Paperback – August 25, 2006 ISBN 0816648859

¹⁸ Šveda, M. (2011). Suburbanizácia v zázemí Bratislavy z hľadiska analýzy zmien krajiny. In: Geographical Journal ISSN 0016-7193.

¹⁹ Kadri L. (2007) Residential Suburbanisation in the Tallin Metropolitan Area, University of Tartu, Journal of Rural Studies, Vol. 5, 123–136.

²⁰ Jablonczay T.- Grajczár T. (2014) Területi identitás stratégiák I. ISBN 978-963-08-6949-2

²¹ Katreen A.T (2010): Reduction of Urban Vulnerability. Coldwar History Volume 2, Frank Class

²² Balizs- Bajmócy. 2018. Rajka – Rapid changes of social, architectural and ethnic character of a cross-border suburban village, Tér és Társadalom 32. évf., 3. szám, 2018. <https://doi.org/10.17649/TET.32.3.3046>

²³ Malhorzata Flava - Liszievsky Maik. 2000. Demographic Consequences of suburbanization in selected towns in the eastern borderlands of Poland, online: <http://apcz.umk.pl/czasopisma/index.php/BGSS/article/viewFile/v10089-010-0011-4/1549>

²⁴ Ministry of Foreign Affairs SR, Ministerstvo zahraničných vecí. <https://www.mzv.sk/cestovanie/covid19/obmedzenia-nahraniciach>

²⁵ Pawera R.-Bott D.L.: 2020. Suburbanizácia a identita, 2018, FutuReg, QUAERE, Volume 4, Hradec Králové, Česká Republika

²⁶ List of Funded Projects INTERREG HU SK <https://www.skhu.eu/funded-projects/infographics>

4 Methods

As for research methods qualitative interviews and quantitative survey forms were distributed. We tested a hypothesis as follows. This is one of the forms of the organised scientific analysis and description of a specific phenomenon or problem in reality, describing it accurately and expressing it by classifying, organising information, seeking to understand the relationships of this phenomenon or problem with other phenomena or problems, and reaching conclusions that contribute to development of the studied reality. This survey was conducted between May – June 2023.

Project impact analysis based on current 2023- Priority Axes in in current call as follows contribute to 3 topics Protection and preservation of Nature, Social Cooperations and Joint Risk Management.

Image 1. Financial Framework Correlation between cross-border policies and project awareness

Priority Axis	Pearson correlation coefficient (R)	Impact Size	Amount in Mil Eur
Protection and preservation of Nature	0,35	1,6	13,08
Joint Risk Management	0,28	0,06	15,4
Social Cooperations	0,35	0,6	21,7

The study survey conducted on local community represents cross-border applicants who are living in cross-border region in the area of INTERREG projects (Trnavský kraj, Bratislavský kraj, Győr-Ménfőcsanak Megye).

The research sample was taken using the purposive sampling method and it consisted of ($N=200$) individuals. After that, the study tool was designed, which is the online questionnaire via the Google Forms application. To verify the psychometric conditions of the tool, the apparent honesty of the tool was ascertained by presenting it to a group of arbitrators with science, experience and knowledge in the fields of scientific research and sociology for evaluation.

The internal consistency was checked by calculating correlation coefficients between the grade of each phrase and the total score of the questionnaire. It was found that the correlation coefficients of each of the scale phrases and the total score of the scale were all statistically significant at the level of significance (0.01), which indicates the availability of a high degree of internal consistency of the scale. To verify the stability of the search tool, the researchers used the Cronbach Alpha standard and the total reliability coefficient of the questionnaire was (0.82). These high values of the reliability coefficient indicate the validity of the tool for application and the reliability and validity of its results. To achieve the objectives of the research and analyse the collected data, One-Sample T Test, One – Way ANOVA to determine the size of the sample effect.

5 Results and discussion

The results of the study showed the following hypothesis were tested and proved. The first question: *What is the level of willingness to live in one settlement (SK) or other (HU) during first programme period (2014-2020) suburbia?* To answer this question, the statistical method represented by the arithmetic average and the One-Sample T Test was used at the level of significance ($\alpha = 0.05$)

Tab 1. Willingness Limits

Willingness Limits	Range	Limits
Strongly disagree	1.00 -1.8	Very Low
Disagree	1.81- 2.60	Low
Neutral	2.61-3.40	Average
Agree	3.41-4.20	High
Strongly agree	4.21-5.00	Very High

The arithmetic average was 4 and freedom axis 500. and T value 11.48. Added to that, the nature of their interaction of the move from one country to other or within the region, in terms of the passed period that was characterised by staying at home due to quarantine, reducing outdoor hours, working remotely, which provided a tremendous opportunity for inhabitants to highlight their positive behaviour reaching the percentage of consensus and high approval. Thus, they achieved their quest for a sense of community, breaking the feeling of loneliness in capital city and social isolation, satisfying psychological needs and bonding with members of the group in the suburban towns. It may also be attributed to the extent of the expansion of reliance on that between 2021-2022 the large number of implemented projects and registered cooperations in the suburbia. (Local Governments, 2022) As for the approval of (11.4%) of inhabitants, this may be attributed to the multiplicity and diversity of unofficially registered suburban addresses were characterised by reliability and high rates compared to the rest of the inhabitants.

Another question was: *Is there a statistically significant relationship between the implementation of INTERREG HU SK projects, suburbanisation and the period of new programme period?*

Tab 2. Correlation between cross-border policy and project awareness

Relationship between project numbers and the Eligible Applicant	Pearson correlation (R)	Impact Size	Sig P value	Sector
Relationship between project awareness in municipalities and crossborder project implementation	0,35	1,6	0,00	PUB
Relationship between school and educational institution activities in crossborder project implementation	0,28	0,06	0,00	EDU
Relationship between crossborder business and crossborder project implementation	0,45	0,6	0,00	BUS

From the above results, it is clear that there is a positive, medium-strength, correlation between move of homes, schools and offices and with the effect of COVID-19 crisis. This means that the greater the more inhabitants move, the greater the fear of the pandemic the COVID-19 crisis to a moderate degree is, and vice versa.

The effect size was (0.154), which means that permanent address changes (15.4 %) have relative high impact on COVID-19 crisis. Along the with statistics by regional development data we compared the origin of the regions, where the cross-border citizens come from the capital and southwestern region. Therefore, we tested their willingness to implement projects during pandemic.

From the previous One-Way ANOVA analysis of the administrative region variable, it is clear that there are statistically significant differences in the opinions average of the sample members about the willingness to change their permanent address to their holiday home, suburban home in promoting positive behavior due to the variable of the administrative region. The impact size is (0.027), which is a weak impact. (2.1%) of the changes in the level of positive pandemic growth.

The third question was how is there a correlation between the region of origin of inhabitant and the willingness to participate in INTERREG HU SK projects in cross-border region?

Tab 3. One Way ANOVA analysis of the administrative regions

Region	Administrative Region	Average	Standard Deviation	F value	P value
Capital City Bratislava	66	3.38	0.74	3.17	0.013
Eastern Region	4	3.61	0.89	3.17	0.013
Southern (original region Trnavsky, Trenčiansky, Bratislavsky)	104	3.36	0.85	3.17	0.013
Western Regions	12	3.39	0.75	3.17	0.013
Northern Regions	14	4.04	0.662	3.17	0.013

This correlation was not proved by strong relationship. While asking about the missing services and projects in suburbia in 2019 respondents answered health care and education as priority, in 2020 schools and services became the focus of the interest and in 2023 healthcare providers and basic malls and services as well as natural heritage and risk management of the region was missing. For motivation to move into projects for institutions and eligible newcomer applicants presented the closeness to capital and rural countryside. There was no point to implement projects directly in capital and implement changes in 2020-2022, as they were the highest closures, this was supported by slighter shift of project stand-by regimes.

In 2019 survey (open question quantitative part) there were three common "mindmap" associations created about Slovak – Hungarian cross-border area, there were the followings: closeness of Bratislava, workmarket and logically lower prices of services as in the capital. Controversary, in year 2022 these advantages became more flexible in terms of home-offices and dominated quiet place, lower prices, family houses. There were several environmental qualities in quality of life mentioned on rural countryside as pure drinking water and natural treasures, but on the other hand, unfortunately, the most common answer here is just moving to cross-border the most economic prices of properties around Rajka region and Bratislava's closeness. Inhabitants, possible applicants of the smaller settlements, proved to be more culturally, socially and publicly active during interviews and opened questions. Another assumption is thus the relationship between Hungarian and Slovak residents examined the importance of the micro-regional economy, it can be concluded that expected accordingly, the micro-regional economic level and local companies are rather important for indigenous peoples. Meanwhile, the capital city's presence is important for having shared centers, multinational companies are more important for those who have moved to cross-border region. It also appeared several times in survey, how they describe themselves as for definition point of view. Before pandemic the places were called sleeping cities, satellite towns, garden towns, suburbias and it turned out that their lives changed due to pandemic and they became to call it home, small towns cross border residencies, close to the capital.

5 Discussion

Slovak and Hungarian cross-border projects became even more complex based on pandemic facts, there is no relevant prognosis available towards demographic grow, neither the population trends nor the covid effect is calculable. There is a different nature, administrative, legal and rural history of the region between two programming periods.

The number of peripheries in the region in the field of trade, and agriculture, intensive care of countries, regions and cities grow significantly. This includes sustainable development, regional and management strategic development and font-based documents, including local authorities, provide information and

advice on how to provide information, for whom are interested in one of the most important projects and suburban areas number of inhabitants.

The comparative study carried out in the Hungarian and Slovak languages, in the north of Austria. This is a natural and important forecast in the framework of the European Community, which is subject of the European Union's programming for INTERREG. Moreover, in the field of sustainable innovation, development of cities and five special characteristics from applicants and inhabitants' profile, the majority comes from Capital City, and Southern region, there is no correlation between the origin of the applicant and cross border willingness to implement projects.²⁷

In another comparative method for mobility mapping it was also found that in similar spatial study by monitoring permanent address a study of doubly constrained gravity model was estimated using generalised linear mixed - effect models for journey-to-work flows in Montevideo, Uruguay.²⁸ This work-flow model was via implemented projects of INTERREG HU SK not proved in our survey.

Wider study has found out the same journey used without moving permanent address. Under the mixed model by framework Poisson and negative binomial regression models were estimated to find a better fit for the last distribution used.²⁹ The model specification improves the parameter estimation by up to 15% which means for our research a comparative result, as our sample of the survey was willing to solve cross-border related issues spatially in 20% based on the willingness and cross-border priority changes.³⁰ These priorities can be further evaluated by the segment of education, public and business, where innovation motivates more the business sector as for the rate of co-financing and feasibility study of projects.

The results were also compared with a generalized linear model GLM³¹ of the same study, where specification improved showing that consideration of origin regions as fixed effects are insufficient to predict independence among flows.³² We can close this comparative method deduction as slightly similar to the hypothesis findings in other territorial and time-specific level with increasing number of cross-border project number movements after pandemic.

5 Conclusions

In conclusion, administrative regions are "thinking" more cross-border in terms of western and southern part of cross-border especially in the neighborhood of Bratislava. Relationship between project awareness in municipalities and cross-border project implementation is selected to be a prior evaluation form to give response to the possible future prognosis, outstanding with the high initiative in eliminating administrative obstacles. For business Relationship between project awareness in companies creates the highest value of expectancy for proper cross-border project implementation. Thirdly, Relationship between project awareness in institutions, especially in educational institutions were decreasing due to other pandemic related priorities, most probably as online education and cross-border project implementation was not strengthened.

²⁷ Sadiq, M. (2020). Policing in pandemic: Is perception of workload causing work-family conflict, job dissatisfaction and job stress? J Public Affairs. e2486. <https://doi.org/10.1002/p.a.2486>

²⁸ Jablonczay T.- Grajczár T. (2014) Területi identitás stratégiák I. ISBN 978-963-08-6949-2

²⁹ Sadiq, M. (2020). Policing in pandemic: Is perception of workload causing work-family conflict, job dissatisfaction and job stress? J Public Affairs. e2486. <https://doi.org/10.1002/p.a.2486>

³⁰ Chun, Y. 2008 Modelling network autocorrelation within migration flows by eige spatial flitterint Journal of Geographical Systems 10: 317-344

³¹ Bavaud, F.-Kordi, M.-Kaiser, C. :2018. Flow autocorrelation a dyadic approach. In: Annals of Regional Science

³² Anderson, J.E: 2015 Fitting linear mixed effect models using IME4 Journal of Statistical & Software 67 (1), 1-48

These include thinking about the area, including its attachment to neighboring settlements, neighboring countries. The second added value of the research article is the comparison of sociologic and geographic aspects caused by COVID-19. Epidemic trends as a new viewpoint for suburbanization and the inhabitants' perception in the field of regional development research identify negative traits, but solutions were not changing forward in the last programme period. This involves new priority axis as Green Europe, Joint risk management, Joint social cooperation in the field of education, business and public governance.

Correlation between forms of applicant and numbers of projects and services to suburbia was higher during COVID-19 as it was shown. Data correlated with the year after pandemic and the growth of population, growth of numbers of project and eligible applicants in terms of territory other than only cross-border. The density of project on infographics is not always a positive decision point, but the concentration of relatively skilled service-based centralized work market, business, institutions and innovative public sector could be therefore centralized more extensively.

Main added value of this article is that at least 20 % higher interest rate of INTERREG HU SK shift in cross-border area of Hungary and Slovakia could have been based on data caused by demographic growth in suburbia official form at this moment are wider due to new cross-border programme territory, they are present positively for the capital city and neutrally to the cross-border surrounding region, which can be a new challenge towards ISG (Innovation Sustainability and Governance) of the new programme period.

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POSSIBILITIES OF DIAGNOSING THE LEVEL OF DEVELOPMENT OF STUDENTS' COMPUTATIONAL THINKING AND THE INFLUENCE OF ALTERNATIVE METHODS OF TEACHING MATHEMATICS ON THEIR RESULTS

^aBRYNDOVÁ LUCIE, ^bKVĚTOSLAV BÁRTEK, ^cKLEMENT MILAN

Palacký University Olomouc Faculty of Education, Žižkovo nám.
5 779 00 Olomouc

email: ^alucie.bryndova01@upol.cz, ^bkvetoslav.bartek@upol.cz,
^cmilan.klement@upol.cz

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Abstract: The testing of students' computational thinking and the development of standardized tools for this testing is one of the most debated issues in the practical integration of computational thinking development. Thus, for more than a decade, there have been initiatives aimed at identifying the algorithmic, programming, and information thinking skills of primary and secondary school students.

The research, the progress, and results of which are the subject of the communication of this paper, has been our contribution to the development of testing tools that would allow for the widespread testing of the level of students' computational thinking, and that are not focused on the use of a specific programming language. As part of it, we were also able to identify a possible link between alternative methods of teaching mathematics, such as the Hejny method, and the deeper development of computational thinking in primary school pupils.

Keywords: Computational thinking, diagnostics, didactic test, test tasks, Hejny method

1 Introduction

Accelerating technological development has brought many radical changes in all aspects of life and has undoubtedly affected the functioning of our society in recent decades. The expanding reach of the digital space and technological innovations leading to the modernization of industry, commerce and households have given rise to a plethora of new concepts related to digital and information technologies and their applications. One of these was computational thinking, which was introduced by Jeannette Wing in 2006 as an essential skill for modern humans who are able to make full use of digital technologies and computational methods to solve everyday problems.

According to Wing, computational thinking is a thought process that enables one to formulate a problem and describe its solution in such a way that it can be effectively handled by a computer, machine or even a human (Wing, 2006). In general, therefore, it is a way of solving a problem that focuses on describing, analyzing and finding an effective way to solve it, emphasizing a systematic approach and the use of concepts known in the field of computer science. It is important to emphasize that the development of computational thinking does imply the development of programming skills exclusively. On the contrary, the concept of computational thinking suggests that everyone, not only the professional computer scientists, can use its related competences and skills. Thus, it contributes to the holistic development of students or students, with overlap into the development of their informatics competences. Since the first introduction of the concept of computational thinking (CT), there have been many international discussions about its precise definition, the specification of its dimensions, and the efforts to integrate the development of CT into the curriculum of educational systems all over the world. The introduction of the concept of computational thinking into academic debate has fostered a pedagogical discourse on the role of digital technologies in education and the possibilities of introducing computer science and programming into national curricula, which has existed almost since the early 2000s (Tran, 2017; Klement, 2018).

Although computer literacy and the targeted development of digital and communication skills are still of considerable importance; there is a tendency to move the targeted development of these skills into the cross-curricular domain as

part of the modernization of the whole education sector (Balanskat, 2018).

Since the beginning of the international debate on integrating the development of computational thinking into the curriculum, numerous attempts have been made to define specific subdomains of computer science. The primary goal of this process is to specify an otherwise very general definition of the phenomenon of computational thinking, which is not suitable for the practical implementation of CT in the school system. Currently, most national curriculum definitions of the concept of computational thinking are based on or frameworks that align with the 2011 CSTA and ISTE definitions of the characteristics and competencies associated with CT use. These definitions were later simplified by many authors, and reduced to basic elements that summarize the original definitions in their essential principle.

Even for pedagogical and educational purposes, the concretization of the areas defining CT is usually done by a detailed analysis of the text of the CSTA and ISTE documents. In the following comparative Table 1, we list the subcomponents of computational thinking based on the CSTA and ISTE definitions and the key words and phrases used in this definition according to Chen (2017). Based on these listed baseline components we define the corresponding CT skills (Angeli et al., 2020, Bocconi et al., 2016, Wing 2014) that are associated with these concepts, and that computational thinking that students are expected to master.

Table 1 Definition of domains for the development of computational thinking

Original definitions of CSTA and ISTE	Keywords	Matching skill CT
Formulate problems for machine solutions	Formulation	Syntax, coding
Logically organize and analyze data	Data	Data processing
Represent data using abstractions	Representation	Modelling
Automate solutions using algorithmic thinking	Algorithmic thinking	Algorithmic thinking, automation
Analyzing possible solutions to achieve the most efficient combination	The most effective combinations	Abstraction, optimization
Generalize and apply a specific process to a solution problem	Generalization	Evaluation, debugging, generalisation

Therefore, continuous research on material conditions, analysis of educational content, forms and methods of teaching, as well as the readiness of teachers, including the necessary competences for the development of computational thinking in their pupils and students, is necessary. In Europe, the European Schoolnet project, for example, has been mapping the problems accompanying the introduction of CT development in schools. According to the results of this research, the most significant shortcomings are the lack of teacher qualifications (Balanskat, 2018) and the absence of the necessary diagnostic tools for identifying the level of computational thinking in students (Tikva & Tambouris, 2021). Thus, a number of research activities in this area can be noted in the definition of CT content (e.g., Brennan, 2012, Kanemune, 2017, Moller & Crick, 2018, etc.), methods of teaching CT (e.g., Rubio et al., 2015, So, Jong, & Liu, 2020, etc.), and forms of teaching CT (Román-González et al., 2017, Tran, 2017, Tang et al. 2020, etc.). However, less research has focused on the area of developing tools for testing students' levels of computational thinking (e.g., Hadad et al.,

2020; Klement et al. 2020; Denning, 2017; Brennan & Resnick, 2012, and others).

2 Opportunities To Test The Level Of Computational Thinking

Consequently, many researchers are currently trying to develop specific diagnostic tools that aim to directly test computational thinking development within students. The purpose of those tools is evaluation of both, the domestic state of development of computational thinking, and determining the position of the results of the state educational system at the international level. In Europe, the pioneer of standardized CT testing is Spain, where the question of measuring the level of CT development in primary school students has been discussed since 2015. Within the global discourse, the United States has come to the academic forefront on the issue of targeted testing.

Probably the most widespread tool of measurement computing skills through didactic testing, which is implemented in the form of a test combining closed and open questions, is a computing challenge Bebras. The challenge focusses on students' general computational skills; however, its main aim is to popularize and promote computer science rather than to diagnose it. In the context of a didactic test measuring computational thinking with open-ended questions, it is worth mentioning the Psychometric Computational Thinking Test, or PCT test, by Julio Santisteban and Jennifer Santisteban-Muñoz (2018). In addition to those, the first standardized test of computational thinking in Europe was the CT-test by Román-González in 2015. This test was aimed at Spanish primary school pupils working in the Scratch environment and was therefore linked to a specific programming environment that the students were used to working with. A similar approach to the level of CT development testing with the use of a specific programming environment was a testing tool constructed by Chen et al. in 2017. This test combined open and closed questions, was designed for fifth-grade students and primarily focused on the use of CT in practical activities of daily living.

Thus, globally, four types of evaluation of student development and performance are typically encountered when testing computational thinking in education, regardless of the level of education. Tang (2019) divides these categories according to the form of pupil work they work with, specifically the form of didactic test composed of open or closed questions, analysis of pupil portfolio evaluation, interview and survey. The following table elaborates the distribution of testing options and with examples of specific applications of the method:

Table 2 Possibilities of determining the level of computational thinking

Type		Practical use
Didactic tests	CT test with open questions	Román-González (2015) Santisteban (2018)
	CT test with closed questions	Dolgopolovas (2015)
Analysis of student work	Analysis of the student's portfolio	Román-González (2015)
	Evaluation of the student's performance in solving the task	Angeli (2020)
Interview	Usually a supplementary form of test	Gülbahar (2018)
Questionnaire	Determines the student's attitude towards CT and related skills	Sáez-López a kol. (2016)

The mentioned tools for testing the level of students' computational thinking, however, may not always be suitable for widespread use, as they are either closely tied to one environment (CT-test) or are not primarily intended for use in

mainstream education and focus more on talented individuals (BEBRAS). Another shortcoming of the assessed testing tools appears in the context of open-ended answers, where functional solutions may conflict with poor syntax, making it difficult to evaluate the results. The student is able to arrive at a solution to the problem presented, but this solution, although correct, does not correspond syntactically to any formal programming language. It is important to note, therefore, that the concept of CT does not relate to the learner's ability to use specific digital and communication technologies. At present, the school system is set up in such a way that the school chooses its own programming language, and there are therefore no official guidelines for selecting this programming language. It is therefore impossible to determine with certainty which programming environment the tested pupils will be able to work in. The use of tasks based on existing environments may favor or disadvantage pupils depending on their experience. Therefore, when designing a test instrument aimed at a large number of respondents, it is necessary to consider the complexity of the task and to simplify terminology that may be unfamiliar to the students.

Taking into account the basis mentioned above, the aim of our research work was to develop a test instrument that would be able to measure the level of development of computational thinking in primary school pupils, to validate and standardize this test on a sufficiently large sample of primary school pupils, to process the obtained results statistically, and to prepare the test in a form suitable for widespread use in primary schools. The constructed test tasks can also serve as suggestions for methodological training of teachers, as well as a possible evaluation tool to determine the general level of development of computational thinking at the time of the general implementation of the new curriculum revision.

3 Design Of A Didactic Test As A Diagnostic Tool

Didactic tests are pedagogical diagnostic tools that are generally used to measure learning outcomes in schools in such a way that they can be subsequently evaluated and interpreted. The term didactic test has quite diverse definitions, depending on the author, but in general, it can be said that it is a test that is oriented to objectively determine the level of mastery of the curriculum in a certain group of people (Chráška, 2016). A quality didactic test must meet certain criteria and exhibit certain characteristics. Typical criteria that a didactic test must meet are validity, reliability and practicality, or objectivity, sensitivity, economy, etc. These criteria should already be considered in the design of the test itself, since the starting point of any test instrument design is, as a rule, the determination of the purpose of the test. The actual verification of the elementary properties of the instrument is then a matter of standardizing it in the context of validation, evaluation and interpretation according to certain predefined rules.

To assess the validity of the questions, the Ebel method was used; in which experts divide the questions into two groups according to importance and difficulty. Each question was rated in terms of importance on a four-point scale with decreasing relevance, i.e. essential, important, useful and irrelevant, with irrelevant questions being excluded from the set. The difficulty scale is a standard three-step scale of decreasing difficulty, i.e. from difficult before medium to easy. The set of questions was then constructed based on expert judgement of the level of difficulty from the easiest to the most difficult questions in sets of three questions.

3.1 Definition Of The Tested CT Framework And Its Dimensions

Due to the nature of computational thinking and the characteristics of its constructs, we anticipated that different test items would have different importance in relation to different CT domains (Abstraction and Decomposition, Algorithmic Thinking, Generalization and Optimization, Evaluation and Debugging, Syntax), while some items may relate to several

different CT domains). For this reason, in the validation of the test items, we included the domain-specific determination, which according to the assessing experts was predominantly needed to solve the individual task. Determining the specific CT domain construct that the component measures is then a matter of determining the validity of the individual test items and the test itself. The internal structure-based validity assumes that each item has different importance in relation to the constructs and that some items are more related to another construct. Therefore, the items were weighted prior to final scoring, as we discuss in the diagnostic instrument validation methodology.

Therefore, for the design of the test, the creation of test items, their validation, standardization, and their formal processing, we drew on a search of the literature dealing with the creation and methodology of didactic tests (Black, 1998; Chráska, 2016; Ackerman, 2019 and others), and especially on the methodological procedure developed by G. Chen (2017). The set of test questions, based on the prior premises, was designed as a level test. The time limit was set so as not to imply an interruption for the vast majority of students. Therefore, the test questions were ordered from easiest to hardest. In this case, there is no statistical bias in the results as the slowest pupils generally do not perform better on level tests when the time is extended (Chráska, 2016).

Based on the set objectives, individual test tasks were designed that would be relevant and adequate to measure the required skills and knowledge in each CT domain. The individual tasks design was based on the intersection of the domestic definition with the internationally understood standard (Abstraction and Decomposition, Algorithmic Thinking, Generalization and Optimization, Evaluation and Debugging) and the component that is specific to the Czech primary school environment according to the National Institute for Education recommendations (Syntax):

- Abstraction and Decomposition - tasks will focus on the ability to simplify a problem to its basic form so that essential information is not lost, and then work with a diagrammatic representation of the problem,
- Algorithmic thinking - tasks will focus on the ability and skill to find an effective and efficient solution to a particular problem and to formulate the solution adequately, quite independently of practical programming,
- Generalization and Optimization - tasks will focus on the ability to break down the whole into sub-components and to work with these sub-components, for example by optimizing functions,
- Evaluation and Debugging - tasks will focus on the ability to analyze the problem, debug it to predict the outcome of the situation and the operation of the algorithm based on a critical analysis of the situation,
- Syntax - in the context of the education of pupils in primary schools in the Czech Republic, we include this dimension following the original definition of CT according to the National Institute of Education. We define it as the ability to write a solution using an adequate programming language or code, at a level appropriate to the age of the pupil, understanding the principle of this writing, and the procedure of the problem solution, compliance with the laws of computer programming, and the ability to rewrite the solution so that it can be understood by a computer or an adequate machine.

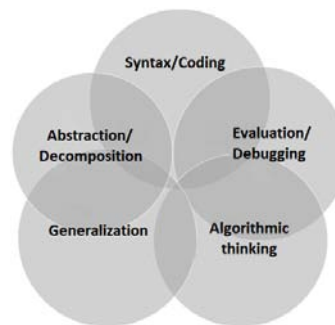


Figure 1 Final definition of dimensions of computational thinking for the purpose of testing the development of CT in primary schools in the Czech Republic

3.2 Design Of The Didactic Test And Its Items

In the development of the set of initial phases of the test items, a total of thirty test items of increasing difficulty were created, corresponding in equal proportion to the five predefined CT domains, from which a number of questions suitable to the age category of the tested pupils were selected after expert judgment.

Each test item was designed to be a closed-ended multiple-choice question. At the time of the beginning of the research, there was no validated computational thinking that corresponded to the legislative definition of the CT concept within the EU and the Czech Republic curriculum. For this reason, the tasks were principally designed on the basis of previous foreign research dealing with the creation of didactic tasks for the development of computational thinking, such as the CT-test by Román-González (2017) and the Beaver of Informatics contest. The content of the test items focused primarily on the areas of computational thinking that are defined by the Ministry of Education within its concept, especially from the revised Primary School Curriculum Framework (2022) and the recommendations of the European Commission, developed by CSTA/ISTE (2012).

The test items were designed so that they were not dependent on a specific programming language or environment and therefore allowed for widespread deployment in the classrooms without the need for specialized software (graphical assignments with the option of printing and manual completion). Each test item consisted of a complex task whose solution required the use of a particular dimension of computational thinking.

To avoid the problem of guessing the correct answers, each item of the test had a choice of four answers. Each question had to be answered within the test, so it was impossible to omit the answer. Each correct answer was scored with one point, and no points were deducted for a wrong answer. The final set of test items was sorted with increasing difficulty, with all CT dimensions of interest represented equally.

Figure 2 Selected test tasks for determining the level of development of computational thinking

Based on expert judgments regarding the difficulty and validity of the test items, we constructed a test set that consisted of 12

questions, which corresponded to the three main domains of the proposed CT theoretical framework; namely Abstraction and Decomposition, Algorithmic Thinking, and Syntax and Coding. For the questions, which were originally designed to determine the level of learners' development in the dimensions of Generalization, and Evaluation and Debugging, the required condition of the consensus of expert assessments regarding the individual task, which had to be over 70 %, was not met. Moreover, while the average agreement of the experts' assessments for the items focused on Syntax and Coding was 69 %, Abstraction and Decomposition corresponded to 68 %, and Algorithmic Thinking reached an average of 62 %, the average agreement of the Generalization and Optimization component reached only 32 % average agreement, and the Evaluation, Debugging and Solution Evaluation component only 32 %. Therefore, it can be suggested, that it is not entirely possible to identify exactly which dimension of CT is predominant within solution of those tasks. This tendency might also be supported by the fact that while evaluating the test items that were originally aimed on exploring the last two low-ranked CT dimensions, the experts did not identify their intended CT dimension as a dominant focus of those test items and gave more priority to Algorithmic Thinking, and Abstraction and Decomposition. For this reason, the Generalization and Optimization, and Evaluation and debugging dimensions were not considered as separate concepts in the final test but were included only as components of the other CT dimensions.

Table 3 Concordance of expert assessments in the validation of test items according to CT dimensions

Targeted CT dimension	Average consensus of expert assessments	Median consensus of expert assessments
Evaluation/Debugging	32 %	31 %
Generalization/Optimization	35 %	33 %
Algorithmic thinking	62 %	64 %
Abstraction/Decomposition	68 %	67 %
Syntax/Coding	69 %	71 %

4 Diagnostic Tool Validation Methodology

The validity of the test items was verified from the perspective of experts dealing with the didactics of computer science and the development of computational thinking, who had the opportunity to assess the validity of the test items, their clarity, difficulty, and appropriateness in relation to the age and context of the test. These experts were from independent departments. This phase of preparation included checks for concurrent validity (comparison with other tests measuring the same ability) and predictive validity (comparison with performance in practice). In this phase of the research, 22 expert practitioners were involved in the validation of the instrument and were able to assess the test item's relevance in the CT domain, its level of difficulty, and its appropriateness to the target population.

Determining the specific CT domain construct that the component measures, is a matter of determining the validity of the individual test items and the test itself. Internal structure-based validity assumes that each item has different importance in relation to the constructs and that some items are more related to another construct. Therefore, items will need to be weighted before final scoring.

Construct validity was further assessed using factor analysis, a technique that "groups observed variables (in our case, test items) into latent variables, (here, the related domain) based on common features in the data (e.g., Atkinson et al, 2011). There are two main approaches for factor analysis (exploratory and confirmatory). Confirmatory factor analysis (CFA) is used when there is an assumption about the underlying structure of the data and to confirm the structural model of the instrument (de Souza et al., 2019), while exploratory factor analysis is typically used

to explore the dimensionality of the data. In our case, which aims to evaluate whether questions focused on each CT domain form coherent groups, we used CFA analysis.

The selected test items that passed expert review were further pilot tested on a selected sample of primary school students and then evaluated.

5 Diagnostic Tool Validation Results

In the course of validating the test instrument, the traits of respondent's gender (boys - girls), year (4th and 5th grade of primary school) and two different schools were monitored among others. The test results were subjected to cluster analysis, which divided the study population into three clusters. The criterion was the overall success rate in the test. The first cluster contained respondents with test scores between 3 and 6. This cluster had the lowest occupancy, namely 10 respondents. The mean score in this cluster was $\bar{x}=5.3$; $SD=1.059$. The other two clusters had similar frequencies. The cluster with scores ranging from 7-8 had 41 respondents, $\bar{x}=7.56$; $SD=0.502$ and the last cluster with scores ranging from 9-12 had 43 respondents, $\bar{x}=9.9$; $SD=0.867$.

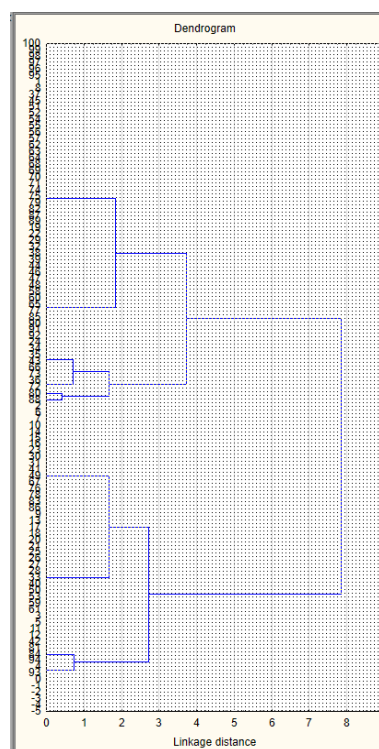


Figure 3 Cluster analysis: results of pupils from both schools

We looked at which variables might affect the partitioning of the data into clusters. First, we used a two-sample Student's t-test of the agreement of means to test whether differences in test scores were influenced by respondents' gender. Forty-four girls and 50 boys participated in the test.

We established the following hypotheses:

- Null hypothesis: $H_0: \mu_1 = \mu_2$; i.e., there are no statistically significant differences between girls' and boys' performances.
- Alternative hypothesis: $H_A: \mu_1 \neq \mu_2$; i.e., there are statistically significant differences between girls' and boys' performances.

From the above table ($p = 0.058$), it is clear that the null hypothesis cannot be rejected. Therefore, the result is statistically insignificant at the level of $\alpha = 0.05$.

Table 4 T-test results for the "gender" variable

Variable	points
Mean0	8.750000
Mean1	8.080000
t-value	1.913691
df	92
p	0.058769
ValidN 0	44
ValidN 1	50
SD0	1.366118
SD1	1.936123
F-ratio Variances	2.008580
P Variances	0.021398

Next, we tested whether the differences between the test scores were statistically significant when comparing students in grades 4 and 5. The test was administered to 51 4th grade students and 43 5th grade students.

We established the following hypotheses:

- Null hypothesis: $H_0: \mu_1 = \mu_2$; i.e., there are no statistically significant differences between the performance of students in grades 4 and 5.
- Alternative hypothesis: $H_A: \mu_1 \neq \mu_2$; i.e., there are statistically significant differences between the performance of students in grades 4 and 5.

Table 5 T-test results for the "grade" variable

Variable	points
Mean0	8.837209
Mean1	8.019608
t-value	2.354369
df	92
p	0.020681
ValidN 0	43
ValidN 1	51
SD0	1.675172
SD1	1.679169
F-ratio Variances	1.004777
P Variances	0.994092

From the above table ($p = 0.020681$), it is clear that we reject the null hypothesis and accept the alternative hypothesis. Thus, the result is statistically significant at $\alpha = 0.05$ level.

We were not surprised by this result; it was expected that there would be the expected difference in performance affected by the age of the pupils.

The final feature that we believe may have influenced the differences in performance on the submitted test was the school that the students attended. The test was taken by 31 pupils from School 1 and 63 from School 2.

We set the following hypotheses:

- Null hypothesis: $H_0: \mu_1 = \mu_2$; that is, there are no statistically significant differences between the performance of the students of School 1 and School 2.
- Alternative Hypothesis: $H_A: \mu_1 \neq \mu_2$; that is, there are statistically significant differences between the performances of the pupils of School 1 and School 2.

Table 6 T-test results for the "method of mathematics teaching" variable

Variable	points
Mean0	9.064516
Mean1	8.063492
t-value	2.748125
df	92
p	0.007213
ValidN 0	31
ValidN 1	63
SD0	1.388896
SD1	1.776849
F-ratio Variances	1.636673
P Variances	0.141141

From the above table ($p = 0.007213$), it is clear that we reject the null hypothesis and accept the alternative hypothesis. Thus, the result is statistically significant at $\alpha = 0.05$ level. This result has already surprised us more. Therefore, we studied the above variables in more detail. In the next graph, the differences between the results of the studied groups are evident.

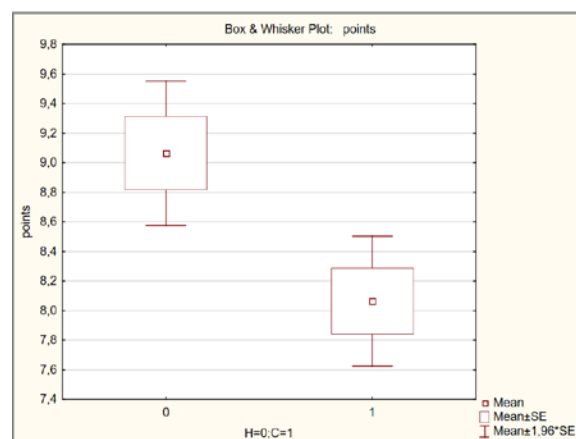


Figure 4 Box Plot comparing success rates in the test

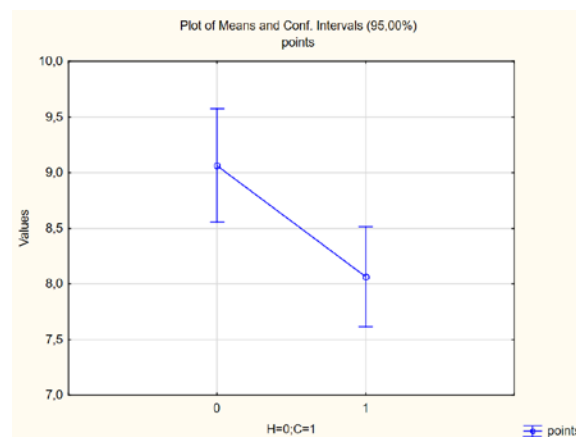


Figure 5 Box Plot comparing means and confidence intervals

We searched for the causes of this phenomenon. The influence of the teacher on students' performance on the observed test offers a logical possibility. However, in this case, we did not develop this reasoning further; the respondents in both sets of observations had received instruction with one, i.e., identical, teacher. We therefore asked what further might account for these differences, focusing on science instruction for computer science and other supporting science. In the course of the investigation, we found that in one of the schools studied, mathematics was taught using an alternative method - Hejny method.

6 Discussion

On the basis of the research results described above, a possible link between teaching mathematics using the Hejny method and the deeper development of computational thinking in primary school pupils was revealed (Bryndová, 2021). In the developed test of computational thinking, pupils who are taught using the Hejny method achieve statistically conclusive better results than students with classical computer science teaching. This increased development is also observed in parallel classes in terms of specific abilities and skills associated with the CT concept. The currently tested sample of pupils shows better skills in algorithmizing (6% better than the parallel sample of pupils taught with classical mathematics), abstraction (5.8% better) and syntax (15% better).

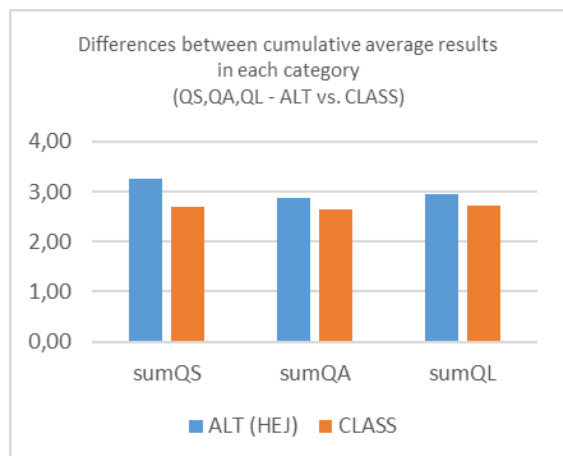


Figure 6 Differences between cumulative average results in each category (alternative teaching vs. classical teaching)

The data also suggest a greater development of computational thinking in pupils taught with HM compared to the global sample tested (about 8%). However, the sample mentioned above is currently very small (for the school with combined mathematics teaching, $n^{HM}=31$; $n^{KM}=63$, so these data have not yet been published. The data are visualized in the following graphs for the complete relevant set of questions (12 test items) with increasing difficulty.

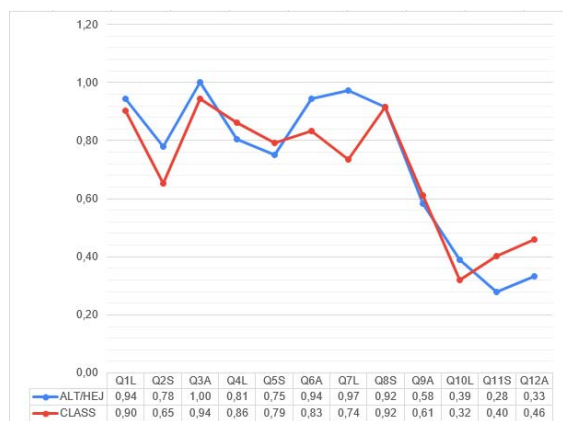


Figure 7 Differences between the averages of the results in each question (ALT vs. CLASS) – blue line= Hejny method; red line = classical teaching of mathematics

Q1, Q4, Q7, Q10 – Questions – Logical thinking
 Q2, Q5, Q8, Q11 – Questions - Syntax
 Q3, Q6, Q9, Q12 – Questions – Algorithmization

7 Conclusion

The development of computational thinking and the modern teaching of informatics in primary schools is currently, in many ways, the subject of extensive discourse worldwide (Li et al., 2021; Bryndová, Klement, 2021; Tripon, 2022 and others). The implemented revision of the informatics curriculum has universally introduced fundamental changes in the concept of teaching informatics in primary schools and introduced a new educational area of Informatics. The primary purpose of this revision is the development of computational thinking, i.e., a set of certain computational skills, qualities and attitudes to ensure that graduates of primary education understand the basic principles of digital and information technologies, and possibly further development in this area.

Thus, at present, many researchers are trying to develop specific diagnostic tools that would be aimed directly at testing computational thinking and would allow evaluating both the domestic state of development of computational thinking and determining the position of the results of the state educational system at the international level. Our contribution in the field of developing testing tools that would allow for the widespread testing of the level of students' computational thinking and not be focused on the use of a specific programming language was the research whose progress and results are the subject of the communication of this paper.

Based on the findings, a possible link between teaching mathematics using the Hejny method and a deeper development of computational thinking in primary school pupils was revealed (Bryndová, 2021). In the developed test of computational thinking, pupils who are taught using the Hejny method achieve statistically conclusive better results than pupils with classical computer science teaching. These results suggest that there is a potentially neglected area of cross-curricular development of computational thinking in the current school system. The interdisciplinary development of computational thinking is directly supported by its original conception, which defines it as a modern problem-solving competency using practices and methods that are primarily prominent in computer science and computing but offer applications beyond them (Wing, 2014). While these results cannot be considered entirely significant, given the size of the research sample, they do suggest a possible direction for further research efforts by the authors' collective. These may focus on research into the impact of alternative methods of mathematics education, such as the Hejny method, on the development of knowledge in specific CT domains (decomposition, debugging, abstraction, (data) modelling and algorithmizing).

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Primary Paper Section: A**Secondary Paper Section: AM**

THE ROLE, TOOLS AND EFFICACY OF ETHICS PROGRAMMES IN CZECH COMPANIES

^aZDENĚK CAHA, ^bIVA KLEMENTOVÁ, ^cJAN URBAN

^{a,b,c}*Faculty of Corporate Strategy, Institute of Technology and Business in České Budějovice, Okružní 517/10, 370 01 České Budějovice Czech Republic*
e-mail: caha@mail.vstecb.cz
email: ^acaha@mail.vstecb.cz, ^bklementova@mail.vstecb.cz, ^c21537@mail.vstecb.cz

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: Organizations facing the question of whether to adopt an ethical management programme not only face this question, but also that of which tools to apply to achieve this. Although having a code of ethics is usually the main tool through which an organisation accomplishes this, it is not the only tool available. For an organisation's ethical management programme to be effective, the tools applied must form an interconnected whole, which is often referred to as a company's "ethical infrastructure". This infrastructure usually includes, among other things, ethical leadership, ethics training and communication for management and employees alike, an internal ethics committee, an ethics officer, etc. The aim of this paper is to describe, analyse and evaluate the main tools organisations use to implement ethical management programmes in addition to a code of ethics. Within this context, the research sought to determine how widespread certain ethical management tools are among Czech companies, what the main factors are that influence their prevalence and structure, and to evaluate how effective these tools are. The results presented in the article are based on an extensive quantitative, as well as qualitative analysis, of a sample of Czech companies of various types and sizes.

Keywords: Code of Ethics; Ethical Leadership; Ethical Officer; Ethical Ombudsman; Ethical Training; Ethical Hot Line; Whistleblowing; Internal Ethical Committee

1 Introduction

Organisations seeking to build a good reputation as a responsible and trustworthy business partner are widely recommended to adopt an ethics management programme (Wood, G. & Rimmer, M., 2003; Statler, M. & Xia, H.M., 2010). The objective of an ethics programme is to influence the behaviour of employees, that is, to promote ethical behaviour and impede unethical behaviour. Such a programme can therefore be regarded as a part of their human resources management policy. Ethics programmes, in this regard, cover both formal organisational control tools, i.e. a system of obligatory rules and enforcement measures to prevent unethical behaviour and promote ethical behaviour (Kaptein, M., 2009), also referred to as "hard control programmes", and what Majluf and Navarrete (2011) call soft control tools, i.e. more casual, intangible, implicit tools embedded in the ethical culture and ethical climate of an organisation.

The code of ethics of an organisation is often closely related to other management tools (Crowther, D. & Seifi, S., 2014), in particular those utilised to implement a company's strategies with regards to corporate social responsibility, corporate governance and compliance management (the system for monitoring and assessing whether a company adheres to certain internal and external rules regarding its business operations). In some cases, the sources for the code of ethics also include the concept of sustainable development of society or of a particular company.

The quality of ethical management is also very closely related to corporate culture, which can be understood to be a "complex of company customs, traditions, values or standards, working ones as well as social ones, written ones as well as unwritten ones, whose importance is based on the fact that they form a framework influencing the behaviour of individual employees or groups thereof" (Curtis, M.B. & Williams, M. E., 2014; Straková, R., et al., 2021). The term ethical culture of an organisation is also used within this context (Park, H. & Blenkinsopp, J., 2013). Ethical management and codes of ethics of organisations are both in theory and practice often linked to the procedures and programmes referred to as corporate compliance (Stucke, M. E., 2014; Skýpalová, R. & Kučerová R., 2014), although they are not identical, and as such, necessitate

different managerial methods of approaching employees, communication and control (e.g. Bohinská, A., 2019; de Klerk, J.J., 2021). The word "compliance" refers to the practices or behaviour of a company, its management and employees, with the set rules of business, i.e. legal regulations and internal directives, including those dictated by the rules of ethical behaviour. Compliance is to a great extent, but not purely, a legal matter (Weber, J. & Wasieleski, D.M., 2013). The system of internal directives and organisational measures in this field is often referred to as the Compliance Management System (CMS). The term usually refers to the set of rules and measures aimed at preventing failure to adhere to regulations, and also usually to ethical standards, by a company or its employees. The relationship to the previously described terms also points to the perception of compliance as a natural part of internal strategy and company culture (Treviño, L.K., et al., 2014). An effective compliance programme may prevent a legal entity from being responsible for a committed crime. Achieving this is a daily challenge for whoever carries responsibility within a company for the compliance sphere (Weber, J. & Wasieleski, D.M., 2013). Compliance management is a system of company management in the form of activities and procedures focused on the prevention, uncovering and response to behaviour that may be considered to contradict internal and external regulations and that may lead a legal entity to be judged as criminally responsible.

Despite the relatively widespread use of these programmes, whose main goal is to clearly define and unequivocally declare, both externally and internally, the principles and rules of ethical behaviour that a company wishes/plans to adhere to (Kaptein, M., 2017), limited empirical evidence exists concerning the effectiveness of these ethics programmes within business organisations. Last, but not least, their effectiveness depends on the structure of the measures for implementing the ethics rules, i.e. the tools for applying ethical management.

The effectiveness of a code of ethics as a single tool for the management of the external and internal relations of an organisation is not a matter of course (Oliver, D., 2016; Hill, R.P. & Rapp, J.M., 2014) due to the spectrum of unethical behaviours being so wide. The efficacy of an ethics programme is therefore based not just on its contents, i.e. clear, understandable and unambiguous formulations (MacLean, T.L., et al., 2014), but also on how the components thereof mutually complement each other, i.e. what methods of creation were used, its use, how they are applied (Singh, J.B., 2011) and enforced on a day-to-day basis (Ruiz, P., et al., 2014), and what attention is paid to corporate social responsibility (Valentine, S. & Fleischman, G., 2008). For the effective, i.e. not just formal, ethical management of an organisation, additional organisational management tools are usually needed which, in the ideal case, form a mutually linked network of instruments that represent a company's "ethics infrastructure" (Garcia-Marza, D., 2017). This ethical infrastructure is therefore not only an important source for determining the content of an organisation's code of ethics, as well as a crucial instrument for its implementation, but also vice versa, the code of ethics serves as its fundamental source of rules and values (McLeod, M.S., et al., 2016.).

In assessing the efficacy of ethics programmes, this study naturally starts with an analysis of the factors influencing the structure and or number of ethics measures and instruments within company ethics infrastructures. Subsequently, it seeks to establish the relationship between the number of components of ethical management programmes that were adopted, the results thereof in terms of the elimination of unethical behaviours, and the relationship between each individual component and the frequency of unethical behaviour (Kaptein, M., 2014). This study also establishes whether there is an optimal structure for components of ethical management programmes and what the relationships are between the types of companies, in terms of size, industrial sector, etc., and the efficacy of such programmes.

2 Theoretical background

Available literature offers a broad array of tools for aligning employee behaviour with established norms and principles. The key instruments of ethical management that form a company's ethics infrastructure, through and with the help of which codes of ethics are implemented, are, as obtained from the WoS and Scopus databases, the following:

Ethical leadership

Leading by example is usually regarded as the prominent "soft" tool of ethical management (Mostafa, A.M.S. & Abed El-Motalib, E.A., 2020), operating on a daily basis "throughout working hours". A comprehensive summary of current research results in the field of ethical leadership is offered by the study of Shakeel, et al. (2020). It touches on four topics, namely the conceptualisation of theories of ethical leadership, the existence of measurement tools for ethical leadership, developments in the field of ethical leadership, and the outcomes of ethical leadership in the context of its positive and negative impacts. The study by Shilu (2018) traces the key elements of ethical management in an organisation in today's rapidly changing world. According to him, an ethical leader thinks about the long-term impacts, challenges and benefits of the various decisions they make in an organisation. They always shows themselves as a modest, stubborn, unifying and helpful person who strives to strengthen goodness and fairness through their actions. Never afraid to take responsibility, their motto is to set high ethical standards that are worth following. They have a strong influence on inculcating the ethical values of the organisation through typical examples of their behaviour. The theme of the impact of ethical behaviour of leaders on employee engagement through enhancing employees' morals is one also taken up by Kamal, et al. (2018). They examine the impact that the transparency of the rules a leader applies and the decisions they make has on an employee's sense of belonging to an organisation. The results reveal that a significantly positive relationship exists between ethical leadership and an employee's sense of belonging to a company. In their article, Stouten, et al. (2013) ponder the question of whether a situation can arise when the leader of an organisation is considered too ethical. Based on the distinct nature of pro- and anti-company employee behaviour, the authors hypothesized that ethical leadership is linearly reflected in deviant employee behaviour (i.e. increased ethical leadership contributes to lower deviance), but with the expectation that its impact on employee loyalty to a company would show a curvilinear relationship (i.e. strengthening ethical leadership helps lower deviance only to a certain extent, then the trend reverses). Specifically, the authors expected that at lower levels, ethical leadership promotes employee loyalty, but at high levels, this affiliation would weaken. Saima, et al. (2020) also study the mechanisms that explain this phenomenon, i.e. the perception of moral blame by employees.

The psychological and social process by which employees resort to deviant behaviour towards their employer is studied by Mostafa & Shen (2020). Ouakouak, et al. (2020) examine how ethical and emotional styles of management influence employee motivation and therefore their work performance. A positive correlation between ethical/emotional leadership and work motivation/job performance was demonstrated, as was the impact of work outcomes on suppressing employees' desire to leave the company. The simultaneous effects of ethical leadership and corporate social responsibility on the considerations of employees of different professions to leave a company, as well as the mediating mechanisms in these relationships, can also be found in the work of Nejati, et al. (2020). The impact of the moral courage and responsibility of leaders on the loyal behaviour of employees as a whole group of people is the subject of the article by Mansur, et al. (2020).

Arrangement and use of whistleblowing

Employees are usually among the first to learn about unethical practices and can point them out. The active notification of a particular unethical practice that takes place within the workplace (Ruiz-Lozano, M., et al., 2016) is therefore an

important component of company ethical infrastructure. An employee may however face various dilemmas in such a situation, in particular with regards to the question of whether they should be disloyal to their colleague(s). Whistleblowing therefore requires an arrangement to be in place, usually integrated in an organisation's code of ethics, which includes an undertaking not to sanction in any way the person that provides the information on the unethical behaviour. The significance of this ethical organisational management tool is backed up by the findings of a worldwide survey on economic crime conducted by PricewaterhouseCoopers Global (PwC's Global Economic Crime and Fraud Survey, 2022). The survey showed that 23% of all the respondents that had faced serious economic crime stated that the behaviour had been revealed by means of a notification system (an anonymous line, helpline etc.) or by notification inside the organisation. Similarly, a survey conducted by KMPG showed that 19% of the 596 analysed cases of economic crime were revealed by whistleblowers. Cases also exist in the Czech Republic where a notification led to the disclosure of criminal activities and consequent punishment. Whistleblowing is therefore one of the most important tools for making disclosures and preventing fraudulent and corruptive practices. The credibility of this tool is therefore higher if the code of ethics of an organisation contains guarantees that the organisation supports an environment in which employees are not afraid to report potential fears and problems, that it does not tolerate any kind of retaliatory measures.

Education and training of employees and managers

Education in the field of ethical behaviour should unify the opinions of all employees on the importance of ethics in everyday work and teach effective communication supporting openness and confidence inside a company (Deogaonkar, An., et al., 2018). Ethics training is considered a costly investment (Warren, D.E., et al., 2014). It is therefore of great interest to what extent it generates a positive return. Steele, et al. (2016) generally acknowledge the positive effects of ethics training programmes, highlighting the considerable variability in the efficacy of ethics training programmes through a discussion of the main issues related to the method of evaluation and format of ethics training. In response to this variability, Mulhearn, et al. (2017) derive a teaching typology in ethics education. A study by Valentine & Fleischman (2004) on a sample of over 300 US businessmen showed significant statistical support for the claim that businessmen employed in organisations using formalised ethics training programmes show more positive perceptions of a company's ethical context than individuals working in companies without such training.

Ethics hotlines allow employees to report suspected illegal behaviour and ethical dilemmas, as well as share their concerns. As they have not yet received much attention in scientific circles, the article by Calderon-Cuadrada, et al. (2009) tries to fill this gap by presenting their characteristics and the level of implementation. Based on an analysis of ethical management codes and compliance programmes in 150 top foreign companies, they monitor the basic characteristics of this mechanism, the degree of difficulty, the share of protective measures, the reported matters and systems for reporting them, and the relationship between hotlines and a company's economic characteristics.

Reporting the risk of a breach of ethics rules

This practice pursues similar goals to whistleblowing, but in a slightly different way. It is based on the obligation of managers and employees to provide the line manager or an appointed company officer with timely and relevant information about a situation in which there is a risk of a breach of the ethics rules (Steele, L. et al., 2016). Such situations include events which might either tarnish the brand name of a company (business ethics, the environment, safety, health), or lead to a breach of their legal obligations. Examples include a deadly injury or serious accident, pollution of the environment, serious environmental accident, etc.

Internal ethics committee

These committees are subordinate to an organisation's management and consists of its managers and employees, primarily the company lawyer, human resources manager and an experienced operational manager. The areas of responsibility of an ethics committee include the provision of counsel on ethical issues, the investigation of alleged breaches of the code of ethics, and the making of recommendations to management.

Ethics officer

Creating the position of Ethics Officer helps ensure the ethical and legal behaviour of employees (Treviño, L.K., et al., 2014). Although these workers often deal with external legitimate challenges, they must face these challenges directly within the organisations they work for. For this reason, it is necessary to simplify their working conditions and thereby help them gain internal legitimacy. A case study by Krambia-Kapardisova, et al. (2019) defines the requirements for the qualifications of these workers, their awareness of their own legal responsibility, the level of knowledge and the nature of the work required, as well as their professional shortcomings perceived by management, committees and regulators. The regulatory implications arising from this study highlight the need for coherence and synergy that can be ensured through unified testing and graduate study in financial compliance. The issue of the role of the ethics officer in a company and their decision-making independence from the management of an organisation is discussed in the article by Hoffman, et al. (2008). It focuses primarily on the question of whether the ethics officer's inherent conflict of interest with management may limit their ability to be an effective monitor and deterrent to unethical conduct across organisations. They come to the conclusion that the current system, in which the ethics officer directly reports to the management of the company, must be changed so that the officer can perform their work effectively.

Ethics audit

An ethics audit (Victor, B., & Cullen, J.B., 1988) can have different focuses (Kaptein, 2015). When it comes to behaviour in an organisation (Kaptein, M., 2020), an ethics audit can focus on the behaviour of one or a limited group of individuals. This usually happens when there are hints or allegations of unethical behaviour (such as signs of bribery, theft and fraud). Alternatively, such an audit may focus on the ethical content of the products and services provided by an organisation.

3 Aims and Research Questions

As stated above, research concerning the efficacy of multiple component ethics programmes has so far been scarce, despite the relevance thereof. After all, such programmes typically consist of a range of areas and aims for the elimination of a broad scale of unethical behaviour. Any research concerning the general efficacy of ethics programmes, in order to be relevant, must therefore be based on a large sample of diverse organisations.

In this study, the structure and impact of ethics programmes on unethical behaviour is therefore examined in terms of six instruments, namely the existence of a code of ethics, the application of ethical leadership, the existence of an ethics officer/ombudsman, the use of ethics training, the existence of an ethics hotline, and the existence of an internal ethics committee. The aims of the research were threefold. Firstly, to determine which additional tools of ethical management ("ethics infrastructure"), i.e. beyond the code of ethics, are used by companies in the Czech Republic. Secondly, to find out the frequency of their presence in companies. Thirdly, to evaluate the relationship between the presence of the main tool of ethical management, namely a code of ethics, to the other most frequently used tools of ethical management in companies in the Czech Republic.

More specifically, the aim was to find out whether and, if so, what the common characteristics of companies are with regards to the number of ethical management tools used and their structure, i.e. the combinations of management tools applied, as

well as to what extent the tools of a company's ethical infrastructure are tied and related to a code of ethics (which is usually the principal ethical management tool), and if the latter is regarded as a prerequisite for efficacy.

On this basis, the following research questions were formulated:

RQ1: Are there characteristics companies share when it comes to determining the number and structure of the ethical management tools they use? Within this context, the following company characteristics were considered: industrial sector, size (no. of employees), scope of territorial activity, financial results (including recent trend), and the presence of a personnel department.

RQ2: Does a relationship exist between the number and type of ethical management tools used by individual companies and their results/efficacy of their ethical management?

4 Data and Methods

The data were obtained through primary research based on a questionnaire survey conducted at the turn of 2018/2019. The research focused on obtaining answers regarding the number and context of the use of ethical management tools in relation to industrial sector, size (no. of employees), scope of territorial activity, financial results (including recent trend), and the presence of a personnel department.

The analysed data matrix therefore consisted of the quantitative variables listed below, of which some are company identification variables and some are of a binary nature concerning the existence of individual components of ethics programmes:

- Industrial sector (primary, secondary, or tertiary)
- Company size (micro, small, medium-sized, large)
- Number of employees (current number of employees)
- Scope of territorial activity (regional, national, transnational)
- Financial results in the last five years
- Projection of financial results for the next 3 years (categories: unprofitable, balanced, profitable)
- Existence of a personnel department (binary variable – no/yes)
- Binary variables concerning the existence/presence of a/an code of ethics, ethical leadership, ethics officer/ombudsman, ethics training, ethics hotline, internal ethics committee

To find possible relationships between the company identification variables and the above listed binary variables, an artificial variable was created with the domain {0, 1, 2, 3, 4, 5}, depending on how many ethical management tools the company used.

The methodology of association rules was used to identify possible relationships between variables. This enabled us to identifying strong relationships, in our case rules, in the following form: if {A, B} then {F}, or if {D} then {A, F}, etc.

For the derivation of these rules, the "apriori" algorithm was used (available through software). The essence of the algorithm can be characterised as a gradual pruning of the least frequent items and their followers. To select association rules from the set of all possible ones, different measures were used to evaluate "interest and significance". The best known and usually the most used measures are "support" and "confidence". These can be roughly defined as follows:

Support is defined for a given set containing elements (items, states) as the proportion of these identical sets in the entire dataset, i.e.

$$\text{Supp}(t_{X \rightarrow Y}) = \frac{N_{t_{X \rightarrow Y}}}{N} = P(X \cup Y)$$

Confidence can be expressed as an estimate of the probability $P(Y|X)$, i.e. the probability of finding Y in a transaction given that the transaction contains X. More rigorously:

$$\text{Conff}(X \cup Y) = \frac{\text{Supp}(X \cup Y)}{\text{Supp}(X)}$$

The numerical calculations were carried out using a combination of the R 3.5.2 programming environment, MS Excel 2016 and own software programmes.

5 Results

In total, 260 completed questionnaires were obtained through the survey. The company characteristics in the sample, based on the identified quantitative variables, were as follows:

Company size: 83 micro, 83 small, 54 medium-sized, 40 large enterprises
 Industrial sector: 12 primary, 105 secondary, 143 tertiary
 Scope of territorial activity: 98 regional, 77 national, 85 transnational companies
 Financial results: 11 unprofitable, 66 balanced, 183 profitable companies

The use of specific ethical management tools by the companies surveyed is summarised in Table 1.

Table 1: Application/presence of ethical management tools in companies in the Czech Republic

Ethical management tool	No. of companies
Code of ethics	152
Ethical leadership	52
Ethics officer/ombudsman	85
Ethics training	39
Ethics hotline/whistleblowing	8
Internal ethics committee	4
None	31

Source: Authors

The number of (multiple) ethical management tools used by the companies surveyed is summarised in Table 2.

Table 2: Number of companies by the number of ethical management tools used

No. of ethical management tools used	0	1	2	3	4	5	6
No. of companies	31	153	52	17	5	0	2

Source: Authors

The other main outcomes derived from the questionnaire survey are as follows:

(i) The vast majority of companies use only one ethical management tool, namely a code of ethics. Further, only 76 companies (i.e. < 30%) use more than one of the ethical management tools under consideration, with just 7 companies using 4 or more.

(ii) A multivariable statistical analysis of the quantitative aspects of the companies reveals that with regards to the use of more than one ethical management tool, the usage of two ethical

management tools is typical. Those enterprises that fall into this category can be characterised as having a code of ethics, operating in the tertiary sector and, as a rule, have (projected) financial results that can be considered as positive or profitable. In some cases, these companies do not have an HR department and - as follows from the aforementioned - do not have an ethics hotline or committee.

(iii) Not a single ethical management tool is used by micro-enterprises, i.e. companies with less than 10 employees, operating in the tertiary sector, and whose activities cover the Czech Republic only. At the same time, the financial results of these companies can be characterised as profitable or balanced.

(iv) Enterprises operating in the tertiary sector (to a small extent in the secondary sector), with up to 50 employees, whose activities are predominantly national (in some cases transnational), with balanced or profitable financial results and a positive outlook, usually use only one ethical management tool.

(v) Companies that use two ethical management tools are mostly large companies (i.e. 50-249 employees) whose activities are predominantly national and that have balanced financial results.

(vi) Companies that use three ethical management tools are mostly large companies (i.e. over 250 employees) that typically operate in the secondary sector, whose activities can be characterised as transnational to national, are profitable and have a positive outlook.

(vii) The number of companies using a higher number of ethical management tools, i.e. 4 or more, was not high enough to make it possible to determine their overall characteristics in terms of the quantitative indicators.

(viii) The quantitative analyses aimed at finding relationships between the presence of codes of ethics and company characteristics revealed significant differences according to company size and scope of activity, although the differences found were far from even and uniform.

6 Conclusion and Discussion

What follows is a summary of the main outcomes of the survey and identified areas of interest for further consideration.

The analysis showed that the majority of companies surveyed used some form of ethical management tool, the predominant one being a code of ethics. Others included the presence of an ethics officer/ombudsman, ethical leadership and ethics training.

On the basis of the results presented, it can be stated that, with regards to the RQ1, the majority of the companies surveyed apply ethical management based on a code of ethics, with only a minority having a broader infrastructure of ethical management tools available to tackle or eliminate the diverse array of non-ethical behaviours that exist. Having a broader set of ethics management tools is characteristic of the largest companies and those that operate transnationally.

These conclusions can be explained both by the fact that the existence of a code of ethics is regarded as sufficient or as an efficient enough tool vis-a-vis the ethical management needs of companies, mainly smaller enterprises, and that ethical management has so far mainly focused on rather formal instruments, whereby greater emphasis has been placed on declaring ones ethical intentions and the external image of the company over a more in-depth approach to ethical management. The latter seems to be supported by the fact that the existence of a personnel department does not apparently play an important role in ethical management.

To some extent, the results (indirectly) support RQ2. It would seem that companies that are larger, with a broader scope of activities, and which are financially more successful, tend to use a more developed structure of ethics management tools.

At the same time, it is clear that a qualitative analysis based on structured interviews with company representatives is needed to further elaborate on the findings. Such an analysis could provide clarity on the main reasons for implementing ethical management in various types of companies, how companies determine there are ethical dilemmas, how ethical management tools are reflected in HR management, to what extent a code of ethics is a product of teamwork, which brings together people from different parts of an organisation, as well as what the specific roles are of the individual tools of ethical management.

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Primary Paper Section: A

Secondary Paper Section: EA, AH

DIFFERENT MUSIC... FRAGMENTS FROM THE HISTORY OF SLOVAK ELECTROACOUSTIC MUSIC AND EXPERIMENTAL STUDIO OF THE CZECHOSLOVAK RADIO IN BRATISLAVA

^aALENA ČIERNA

*Department of Music, Faculty of Education, Constantine the Philosopher University in Nitra
Dražovská ul. 4, 949 01 Nitra, Slovakia
email: ^aacierna@ukf.sk*

Abstract: The paper presents a brief look at selected chapters from the history of electroacoustic music in Slovakia in the 20th and 21st centuries. Despite all the vicissitudes of its development (both condemnation and glorification), electroacoustic music has been a vibrant, pulsating and dynamic sphere of Slovak musical art for over sixty years. The birth and formation of electroacoustic music in Slovakia was primarily the work of two studios – the Sound Studio of the Cs. Television and the Experimental Studio of the Cs. Radio in Bratislava (*EXS*), standing at the cutting edge of technological development. Slovak composers of several generations created their electroacoustic musical visions there. While the activities of the Sound Studio of the Cs. Television were gradually curtailed due to political pressure on television production, the activities of the *EXS* were gaining in genre breadth and artistic depth. Although *EXS* eventually lost its institutional base in the 21st century, its activities have not diminished and it continues to pursue artistic *Ars Acustica*.

Keywords: Slovakia. Electroacoustic music. Sound Studio. Television. Experimental studio. Radio. Slovak composers.

"There are no non-musical sounds, there are only musical and non-musical connections."

Ivan Parík, composer (1936-2005)

1 Prolegomena

The genesis of "different music..." reaches to the turn of the 19th and the 20th century, and it is connected to the composers' efforts for a new sonority. It was Luigi Russolo who claimed that "... we must break at all cost from this restrictive circle of pure sounds and conquer the infinite variety of noise-sounds (*The Art of Noise*, 1914).¹ It was Edgard Varèse who, in his first spatial compositions, drew inspiration from the from Józef Hoene-Wroński's, that music is "... the corporealization of the intelligence that is in sound", and he perceived sounds as living matter created so that "... one could freely dispose of it without limitations by scholastic bonds and academic notions of the intervals" (*Memories and Thoughts*, 1960).² And, finally, it was John Cage who saw the future of music in the "... organization of sound", since the composer of the future "... will be faced not only with the entire field of sound but also with the entire field of time" (*The Future of Music: Credo*, 1937).³ However, the actual history of a "different", autonomous electroacoustic music began to unfold only after World War II, in several musical centres (Paris, Cologne, New York) synchronously.

Already at its birth, diverse aesthetic attitudes and composers' poetics were being formed, depending on the material used, on the compositional techniques, and on the various dispositions to performance and perception. Somewhere here lies the germ of electronic, experimental, electroacoustic, stochastic music, and of *musique concrète*, music for tape, live electronic music, computer music, *musique acousmatique*, environment sound, radio art, sonic art, sound art, etc. In the course of their historical development, and in their concrete artistic forms, these various types intertwined and influenced each other, resulting in the diverse combinations and modifications of "different music" that we have today.

In spite of all the peripeteia of its development (its execration as well as glorification), electroacoustic music has, for more than sixty years now, represented a lively, throbbing and dynamic sphere of music, resting on the actual development of

technologies and sciences which are connected to music only seemingly marginally. Especially since the end of the 20th century, electroacoustic music has experienced a quantitative (and not always qualitative) growth hand in hand with commercial computerization and the global development of digital information technologies. On the one hand, this follows from a gradual suppression of "collective" experimental authorial works in the field of academic institutions and the media, especially in the public sector, which were there at its birth and which supported, developed, and "controlled" it for decades. On the other hand, it was determined by the individualization and amateurism of authorial works as a consequence of the communication of a global community via the Internet and of the financially widely available computer technologies. Although few of us realize it today, with the radical pluralization and interdisciplinary interactivity of the artistic sphere, electronically processed sound penetrated into almost the entire musical development, as well as into other forms of art, including conceptual and media projects at the end of the 20th century. Those who were sceptical at first and spoke, with contempt, of the "dehumanization" of music, fiercely rejecting any form of "experimental" music as an elusive expression of post-war shock and spiritual chaos, or cheap cultural and commercial fraud, fell silent.

2 The Genesis of Electroacoustic Music in Slovakia

The roots of the genesis of Slovak electroacoustic music rest in the dynamic and controversial social and political period of the turn of the 1950s and 60s, when an emerging young generation of composers openly supported post-Webernially oriented New Music in spite of the disinterested or, even, rejecting attitude of local cultural politics towards the music of the protagonists and post-war followers of the European musical Avant-garde.

Pioneers of New Music in Slovakia included composers Ilja Zeljenka, Roman Berger, Pavol Šimai, Miro Bázlik, Peter Kolman, Ladislav Kupkovič, Jozef Malovec, Ivan Parík, as well as musicologists Ivan Mačák, Peter Faltin, and Miroslav Filip. In an effort to develop contacts with contemporaneous European developments in music, and to find their own place and path in Slovak music, the youth turned their attention also to the possibilities of electroacoustic music. At the end of the 1950s, when one could work in technically well-equipped electroacoustic studios in Paris (*Club d'essai de la R. T. F.*, 1948), Cologne (*Studio für Elektronische Musik*, 1951), but also in Warsaw (*Experimental Studio of the Polish Radio*, 1957), or London (*Radiophonic Workshop BBB*, 1958⁴), the first primitive sound experiments took place in Slovakia.⁵ The proximity of the centres of New Music (Donaueschingen, Darmstadt, and Warsaw), as well as the availability of the radio signals of the Viennese *Österreichischer Rundfunk*, enabled young composers to react to contemporaneous stimuli promptly. These were forged into the first electroacoustic opuses in the privacy of Ilja Zeljenka's and Roman Berger's studios as the results of teamwork (I. Zeljenka, R. Berger, P. Kolman, P. Šimai, I. Mačák). At the time, young authors had only two simple, Czechoslovak-made Tesla Sonet Duo commercial tape recorders, an East German tape recorder with a time indicator, and a borrowed four-input mixing console.⁶ The first attempts at

⁴ In Ivan Stadtrucker's essay in 1969 (*História jedného zvukového pracoviska*, [History of a Sound Studio]) published in *Slovenská hudba*, Vol. 13, Nos. 9-10, pp. 342-349) it is stated that the *Radiophonic Workshop of the BBC* was established already in 1956. According to the official website of the BBC, <http://www.bbc.co.uk/music/artists/39f0d457-37ba-43b9-b0a9-05214bae5d97>, the studio was created on 1 April 1958 and closed in 1998. [Retrieved on 20-11-2014.]

⁵ See STADTRUCKER, I.: *História jedného zvukového pracoviska* [History of a Sound Studio]. In: *Slovenská hudba*, Vol. 13, 1969, Nos. 9-10, p. 344; BERGER, R.: *Esej o elektroakustickej hudbe* [An Essay on Electroacoustic Music]. In: *Rozhlas a slovenská elektroakustická hudba*. [Štúdiijný zošit metodicko-výskumného kabinetu.] Bratislava: Metodicko-výskumný kabinet Čs. rozhlasu, 1989. pp. 111-150.

⁶ KAJANOVÁ, Y.: *Rozhovory s Iljom* [Discussions with Ilja]. Bratislava: Vydavateľstvo Spolku slovenských spisovateľov, 1997. pp. 62-68. ISBN 80-88735-59-9

¹ According to COX, Ch. – WARNER, D. (eds.): *Audiokultúra : Texty o modernej hudbe* [Audio Culture: Readings in Modern Music]. Bratislava: Hudobné centrum, 2013. pp. 30-34. ISBN 978-80-89427-22-2

² VARESE, E.: *Erinnerungen und Gedanken*. In: *Darmstädter Beiträge zur Neuen Musik*. B. Schott's. Mainz 1960. [Translation into Slovak language V. Godár.] [online]. Available on: <http://www.sonicart.sk/archives/516>. [Retrieved on 26-06-2023.]

³ CAGE, J.: *The Future of Music: Credo*. In: *Slovenská hudba*, Vol. 22, 1996, No. 1-2, pp. 294-295.

composing with tape recorders were marked by a fascination from discovering a new horizon of sound, deepening the semantic message of the composer. The young composers refined not only their hearing and analytical abilities, but new compositional techniques as well: the technique of montage and that of collage.⁷

Figure 1: TESLA Sonet Duo ANP 210 tape recorder⁸



Source: <http://www.oldradio.cz/mgf.htm>. [Retrieved on 19-11-2014]

3 The Sound Studio of the Czechoslovak Television in Bratislava: Film

It was the genre of films which provided the first professional conditions for the momentary fascination by sound and for students' "pranks" to become Avant-garde works of art. In the Czechoslovak Television in Bratislava, Ilja Zeljenka's music, in collaboration with sound engineer Ivan Stadtrucker, for the film *65 miliónov* [65 Millions]⁹ was created as early as 1961, and it brought the first recognition to Slovak electroacoustic music abroad, at the International Congress of Electronic Music in Florence (1968). Usually that moment is considered to be the birth of the first experimental studio in Slovakia, the Sound Studio of the Czechoslovak Television (ZvČs) in Bratislava.¹⁰ It was here that two of Zeljenka's electroacoustic studies (*Štúdia 0,2* [Study 0.2] [1962], and *Štúdia 0,3* [Study 0.3], [1962]) were created, one of which found its way, along with the soundtrack of the film *Výhybka* [Railway Switch] by Jozef Malovec, to the first and, for long years, the last LP record released by Supraphon in 1966.¹¹

Although the technical equipment of the Sound Studio of the Czechoslovak Television in Bratislava was not completely satisfactory in the beginning¹², gradually other Slovak composers, like Ladislav Kupkovič, Jozef Malovec, Roman Berger, Pavol Šimai, Svetozár Stračina, as well as German composer Paul Dessau, also became interested in working

there.¹³ The young composers found enthusiastic partners in sound engineers Ivan Stadtrucker, Ján Rúčka, Milan Kubiš, and Otto Bartoň, so, in the course of somewhat less than five years, electroacoustic music was being produced for several dramatic pieces and TV productions, for short documentary films as well as feature films.¹⁴ The reputation of the studio kept growing and technical equipment was being procured,¹⁵ but the emphasis on subordinating the music exclusively to the stage or television images resulted in the absence of autonomous electroacoustic music in the production of the studio. The first attempt in this direction was I. Zeljenka's music for the ballet *Kozmos* [Cosmos] which, however, remained a fragment. The music for the ballet *Faust* by W. Bukovský, who passed away prematurely, also remained unfinished. The growing political pressure on artistic creations in the television, and the reorganization of the staff, led to a gradual suppression of the activities and to the dissolution of this progressive experimental studio in Slovakia.¹⁶

Figure 2: The Sound Studio of the Czechoslovak Television in Bratislava (1961): Ivan Stadtrucker (sound engineer), Ilja Zeljenka (composer) [from left].



Source: Archive of the EXS.

4 The Genesis of the Experimental Studio: The Trick Production Room of the Czechoslovak Radio in Bratislava

At the time, however, another experimental studio was being formed in Bratislava, the Trick Production Room of the Czechoslovak Radio in Bratislava (1964)¹⁷, which came into being at the initiative of oral directors. The Trick Production Room had suitable technical equipment available at the time: there were devices made by the Development Department of the Czechoslovak Radio in Bratislava¹⁸ (including a so-called trick

⁷ For the first time since the birth of the phenomenon of electroacoustic music, a fragment from the early team experiments of I. Zeljenka, R. Berger, and P. Šimai, will be published as an LP-CD called *Zaba* [Frog] in *Experimental Studio Bratislava Series 1 – 2 – 3* in 2014. For details see www.sonicart.sk.

⁸ Illustrative photograph taken from <http://www.oldradio.cz/mgf.htm>. [Retrieved on 19-11-2014.] It was a two-track, two-speed mono spool tape recorder manufactured in 1959/1965 (4.76-9.53 cm/sec. speed; 50-10 000Hz frequency range [9.53 cm/sec.]; operated by valves [Czechoslovak patent 96168]; record and pause button; three-digit counter; thermionic indicator of the recording level). The Tesla Sonet Duo tape recorder was developed from its predecessor, the Sonet tape recorder, from which it differed mainly in its speed of 4.76 cm/sec., inputs for more sound sources with their respective switches, a pause button, a counter, and a connection adaptor.

⁹ The original title of the film was *Baladická suita* [Balladic Suite] but it had to be changed for ideological reasons.

¹⁰ This date was stated as the foundation date of the Sound Studio of the Czechoslovak Television in Bratislava, with provisional facilities on the first floor of the ex-Tatra Bank, in the *International Electronic Music Catalog* (DAVIES, H.: *Répertoire international des musiques électroacoustiques/International Electronic Music Catalog*. Paris, France: Groupe de Recherches Musicales de l'O.R.T.F.; Trumansburg, New York: Independent Electronic Music Center, 1968.). After STADTRUCKER, 1969, pp. 342-349.

¹¹ Ilja Zeljenka: *Štúdia 0,3* pre sínusový generátor [Study 0.3 for a sinusoidal generator] (1962). LP, Supraphon DV 6221. 1966. In: *Slovenská hudba*, Vol. 22, 1996, Nos. 1-2, p. 319.

¹² At the time, Sound Studio of the Czechoslovak Television in Bratislava (next ZvČs in Bratislava) had: 4 Sander-Jansen studio tape recorders, a sinusoidal wave generator and, later, a home-made ring modulator based on the designs of Polish musicologist Józef Patkowski. After STADTRUCKER, 1969, p. 345.

¹³ German composer Paul Dessau (1894-1979) came to Slovakia to create electroacoustic music for the documentary film *Ruský zázrak* [Russian Miracle] (Deutsche Film AG [DEFA], 1963) by Annelie and Andrew Thordike.

¹⁴ From August 1961 to May 1964, electroacoustic music was created in the ZvČs in Bratislava for a total of 14 short films and 4 feature films. The latter were: *65 miliónov* [65 Millions] (Ilja Zeljenka, 1961), *Slnko v sieti* [Sun in the Net] (Ilja Zeljenka, 1962), *Každý týždeň sedem dní* [Seven Days Every Week] (Ilja Zeljenka, 1964), *Výhybka* [Railway Switch] (Jozef Malovec, 1964); electroacoustic music for television adaptations: *Vzbura na ulici Sycamore* [Rebellion in Sycamore Street] (Roman Berger), *Kosmos* [Cosmos] (Ilja Zeljenka). After STADTRUCKER, 1969, pp. 342-349.

¹⁵ In 1969, ZvČs in Bratislava had a tape transcription studio, a trick and sound production room equipped with sound sources (12 pcs of tone generators of sinusoidal waves, 1 pc of a tone generator of sawtooth waves, 1 pc of a tone generator of square waves, 1 pc of a generator of white noise, 1 pc of Subharbord), regulators (1 pc of a time regulator, 1 pc of an equipment for a continuous variation of speed, 1 pc of a tape echo, 1 pc of a one-octave bandpass filter, 1 pc of a 1/3 octave bandpass filter, 1 pc of a bandpass filter of variable bandwidth, 1 pc of a band-stop filter of variable bandwidth, 1 pc of a keyer), recording and reproduction devices (4 pcs of studio tape recorders 38 – 19, 9.5 cm/sec., 6 pcs of synchronous studio tape recorders, 1 pc of a 12-channel mixing console). After STADTRUCKER, 1969, pp. 342-349.

¹⁶ STADTRUCKER, I.: Slovenské osudy hudby elektronickej [Slovak Fortunes of Electronic Music]. In: *Slovenská hudba*, Vol. 22, 1996, Nos. 1-2, pp. 34-47.

¹⁷ Because of a lack of suitable premises, the Trick Production Room was housed in the building of the Czechoslovak Radio in Bratislava in Jacob's Square, in R-4, which was originally meant for theatre production but was later adapted to the requirements of modifying speech and music by electroacoustic means. See JANÍK, P.: Premeny technického zariadenia Elektroakustického štúdia [Transformations of the Technical Equipment of the Electroacoustic Studio]. In: *Rozhlas a slovenská elektroakustická hudba*. [Štúdijský zosil Metodikovo-výskumného kabinetu.] Bratislava: Metodicko-výskumný kabinet Čs. rozhlasu, 1989, p. 174.

¹⁸ Already at the end of the 1950s, the program producers of the Czechoslovak Radio felt they were in need of devices for special effects. Therefore, the Development Department of the Czechoslovak Radio in Bratislava, headed by Mikuláš Zima,

recorder, adjusted from a Sander-Jansen 100 studio tape recorder¹⁹), a mixing desk with a monitor speaker (combined design), a connection panel and several generators (Tesla BM 344 RC-generator, RFT 205 recording generator, a Fernmeldemessegerätebau Berlin 120–121 sound generator, a KRÍŽIK G 571 generator of very low sinusoidal and rectangular waves from 0.01 to 70Hz, a rectangular wave generator in the range of 50Hz to 10kHz [the studio's own make based on ORION 1142], a source of narrow symmetric impulses with a continuous variation of frequency [the studio's own make], a source of narrow non-symmetric impulses with a continuous variation of frequency [the studio's own make], a noise generator with outputs for wide-band noise and narrow-band noise of a low frequency for aleatoric modulations [the studio's own make].²⁰

Figure 3: The *EXS* trick recorder of the Czechoslovak Radio in Bratislava (1965).



Source: Archive of the *EXS*.

In modest premises (in an area of 2m x 5m), simple electroacoustic sound figures (of a concrete and electrogenic character) were produced with the aim to highlight the artistic messages in studio productions and dramatic works. Thus, the trick production room stepped on the path of designing sound for special radio broadcasts, i.e. on the path of *radiophonics*.²¹ The verbal and musical units of the Czechoslovak Radio in Bratislava gradually expanded the studio and its technical equipment.

5 The Beginnings of the *EXS*

The year 1965, when the Experimental Studio of the Czechoslovak Radio (*EXS*) was officially founded by the appointment of composer Peter Kolman to the position of a dramaturge, was a turning point in the development of Slovak electroacoustic music. Kolman's high musical professionalism and passion for Avant-garde works led to the profiling of the artistic and technological line of the *EXS*, and to its gradual establishment in the European experimental environment. Very early, the *EXS* ranked among the progressive European studios, which represented characteristic electroacoustic schools by their productions and artistic programmes. During the eleven years of

focused its attention on producing these devices and, based on foreign models, it made an effect device for producing sound figures. See JANÍK, 1989, p. 173.

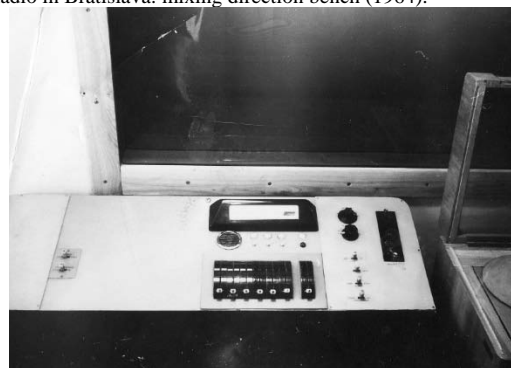
¹⁹ The essence of a so-called trick recorder (also called the "mother of directors"), made by modifying a classic commercial tape recorder, was given by one recording and four playing heads placed at different distances, and a continuous variation of speed from 19 cm/s to 76 cm/s. This modification enabled a continuous variation of speed in the range of three octaves, the production of an echo and feedback and, later, when stereo was introduced, a distribution of the sound material on a reproduction basis. See JANÍK, 1989, p. 174.

²⁰ After KOLMAN, P.: Elektronische Musik in Bratislava. In: *Slovenská hudba*, Vol. 11, 1967, No. 8, pp. 348–351, and after archived documents.

²¹ Experimental studios set up in radio institutions did sound design, i.e. *radiophonics*, according to the requirements of the dramatic units. This is how one of the most significant European studios in this field, the *Radiophonic Workshop of the BBC*, also worked; by musical, literary and dramatic programmes with innovative sounds, it had an impact on the perception of a new sonority on a massive scale. For details see ĐURÍŠ, Juraj. Na ceste k umeniu zvuku / sonicART [On the Way to the Art of Sound / sonicART]. In: *Zvuk v súčasnej hudobnej kompozícii*. Žilina: Žilinská univerzita, 2012, pp. 296–297. More on this, see also *The BBC Radiophonic Workshop*. In: <http://www.bbc.co.uk/music/artists/39f0d457-37ba-43b9-b0a9-05214bae5d97>. [Retrieved on 20-11-2014]

Kolman's activities as its art director, the *EXS*²² developed contacts with several experimental studios²³ and representatives of electroacoustic music: Karlheinz Stockhausen, Józef Patkowski, Mauricio Kagel, and others.

Figure 4: The Trick Production Room of the Czechoslovak Radio in Bratislava: mixing direction bench (1964).



Source: Archive of the *EXS*.

Ever since its beginnings, the *EXS* was built, at the initiative of Polish musicologist Józef Patkowski, after the model of the Experimental Studio of the Polish Radio in Warsaw. The equipment of the *EXS* was added gradually, from local and foreign sources. Already in 1966, a generator of short impulses and a rhythm machine from the Development Department's own resources were added to the technical equipment of the *EXS* and, in 1969, it procured foreign devices, a four-track Studer J 37²⁴ tape recorder and a Subhachord²⁵ sound synthesizer.

Figure 5: Subhachord from the *EXS* (1969). Photo after reconstruction from 2009.



Source: Archive of the *EXS*.

²² Peter Kolman was the art director of the Experimental Studio in Bratislava from 1965 to 1976, when he emigrated and settled with his family in Vienna.

²³ Already in 1965, the studio developed contacts with ten foreign studios to gain information on the situation of experimental activities in the world. The studios which sent information material and promised to help in the form of information on technical equipment and work organization were: Studio für elektronische Musik Köln am Rhein, Electronic Music Center of Columbia and Princeton Universities, Studio voor Elektronische Muziek at Utrecht University in the Netherlands, the Electroacoustic Studio in Gravesano, the Experimental Music Studios at the University of Illinois in Urbana, and the Experimental Studio of the Polish Radio in Warsaw. Later on, Peter Kolman developed and systematically maintained contacts with more than 250 partner institutions. See ČIERNA, A.: Experimentálne štúdio v zrkadle doby [Experimental studio in the mirror of the times]. In: *Hudobné inštitúcie na Slovensku [Music institutions in Slovakia]*. [Zborník príspevkov z konferencie]. Bratislava: Slovenské národné múzeum Bratislava, 2012, pp. 165–182. ISBN 978-80-8060-302-1.

²⁴ The four-track Studer J 37 tape recorder was at the disposal of the *EXS* already in 1965, but was not part of its permanent inventory. See KOLMAN, 1967, p. 351; see also JANÍK, 1989, p. 177.

²⁵ Subhachord (made by RFT in Berlin) was one of the first electroacoustic devices in the countries of the Socialist Bloc. It found its way to the electroacoustic studios in the Czech and the Slovak Republic in 1969. In the *EXS* itself, it was used for a large number of dramatic and documentary works of incidental and utility music. The device consisted, among other elements, of: a generator of sawtooth impulses with subharmonic dividers, an upper and a lower frequency filter, 12 formant filters for the imitation of classical musical instruments, a frequency vibrato, chorus modulation and circular modulation, a keyer for the signal dynamics, etc. The keyboard enabled a regulation of the dynamic progression as well as a single-voice control of the generated signal. See JANÍK, 1989, p. 178; see also KOLMAN, 1967, p. 351 and STADTRUCKER, 1996, Nos. 1-2, p. 37;

The range of the artistic activities of the *EXS* was quite wide, from the production of sounds and sound effects, and fillers for radio bands and plays (*radiophonics*), through processing spoken word, up to electroacoustic incidental and autonomous music. Contrary to the *ZvČs* in Bratislava, the attention of the *EXS* was focused, from its very beginnings, primarily on the production of autonomous experimental electroacoustic and concrete compositions. An extremely creative production team headed the studio: sound engineers Peter Janík and Ján Backstuber,²⁶ along with art director, composer and dramaturge Peter Kolman.

6 The First Achievements of the *EXS*

In the autumn of 1966, the first autonomous Slovak electroacoustic composition, Jozef Malovec's *Orthogenesis*, was created in the *EXS*, with the incidental music for the grammophone record *Moderná svetová básnická tvorba v slovenských prekladoch* [*Modern World Poetry in Slovak Translation*] (released by Supraphon in its Gramoklub edition, 1967), forming its basis. Its "pseudo" stereophonic version was made in the same year, in the radio drama of Production Room 6 of the Czechoslovak Radio in Bratislava, where 4 monophonic tape recorders were available. After cutting the recording mechanically (montage, collage) and adding reverberation, all four tapes were synchronized. Mostly this meant a dynamic mixing with "... localizing each track at a constant place on the stereophonic base".²⁷ A year later, the first stereophonic version of Malovec's *Orthogenesis*, mixed on Studer C 37 tape recorders and a Tesla (SRK type) mixing console, was created in the Research Institute of the Radio and the Television in Prague (on 13 March 1967). The world premiere of the work was played at a seminar on electroacoustic music in Pilsen in the presence of Pierre Schaeffer.²⁸ As its Slovak premiere, the stereophonic version of the *Orthogenesis*, for which J. Malovec received the Award of the Czechoslovak Critique, was played in the 1st year of the seminars on contemporary music in Smolenice in the presence of K. Stockhausen and musicologists C. Dahlhaus and H. P. Reinecke.²⁹ In 1968, a quadroversion of the *Orthogenesis* was produced on a Studer J 37 four-track tape recorder and, in the spring of 1968, it successfully represented Slovak electroacoustic music at the International Congress of Electronic Music in Florence.³⁰ The *Orthogenesis* became a success also at the international competition in Dartmouth College, and was released on an American LP by Turnabout-Vox.

²⁶ Sound engineer Ján Backstuber joined the *EXS* on Peter Janík's request in early 1968, after the studio had moved to new premises freed for the use of the radio by the Post Office on the ground floor of their building in Jacob's Square in Bratislava.

²⁷ Since there were no stereophonically equipped production facilities, not even stereophonic tape recorders in Bratislava at the time, the stereoversion was "produced" by using a Phillips RK 56 commercial tape recorder (with a speed of 19 cm/s). See JANÍK, P.: Elektroakustické intermezzo [Electroacoustic Intermezzo]. In: *Slovenská hudba*, Vol. 22, 1996, Nos. 1-2, pp. 51-52. On the development of stereophony in Slovakia see also BREZINA, P.: The Development of Stereophonic Sound in Slovakia. In: *Journal of Electrical Engineering*, Vol. 62, 2011, No. 6, pp. 370-374. DOI: 10.2478/v10187-011-0060-9. ISSN 1335-3632.

²⁸ The Bratislava premiere of the stereophonic version of Malovec's *Orthogenesis* took place at a public performance in the Concert Hall of the Czechoslovak Radio in Bratislava on 15 March 1967. After JANÍK, 1996, p. 52.

²⁹ See CHALUPKA, Ľubomír: Jozef Malovec / *Orthogenesis*. In: *Hudobný život*, Vol. 34, 2002, No. 4, pp. 29-30. See also ČIERNA, A.: Poetika elektroakustických kompozícií Jozefa Malovca [Poetics of Electroacoustic Compositions by Jozef Malovec]. In: *Osobnosti slovenskej hudobnej tvorby II* [Personalities of Slovak music production]. [Zborník príspevkov z 3. a 4. seminára Tadeáša Salvu, Lúčky pri Ružomberku 2003 a 2004.] Banská Bystrica: Akadémia umení, 2006. pp. 51-63. ISBN 80-89078-21-4.

³⁰ The quadrophonic version of the *Orthogenesis*, which its author called the *Fiorentinese*, was produced on a four-track Studer J 37 tape recorder, with the extensive help of a trick recorder, and with making use of the possibilities of modifying stereosignals on a Tesla TRK 186 mixing console. After JANÍK, 1996, p. 53.

Figure 6: The beginnings in the new premises of the *EXS* in 1968: Peter Janík (sound engineer), Jozef Malovec (composer) [from left].



Source: Archive of the *EXS*.

In the latter half of the 1960s, key personalities (J. Malovec, P. Kolman, L. Kupkovič, R. Berger, M. Bázlik, I. Parík, J. Pospíšil, T. Salva) of the then young generation of composers came to the *EXS* and electroacoustic music became an organic part of Slovak music in a national as well as international context.

7 Rebuilding the *EXS*: The Second Generation of Technological Facilities

The *EXS* moved from the unsuitable premises of the small Production Room 4 (1968) to a new place, innovated its technical equipment to a significant extent, and switched to stereo operation. As a result, electroacoustic production in Slovakia experienced a new boom.³¹ The production of stereophonic recordings also increased in the verbal field since, in the first half of the 1970s, the Czechoslovak Radio placed a great emphasis in its broadcasting on the use of modern means of expression in the field of spoken word. By 1975, 84% of the total number of 94 stereophonic literary and dramatic programmes was produced in the *EXS*, e.g. Ramuz: *Dolina Derborance* [*The Derborance Valley*] (directed by Vladimír Rusko sr.), Hudec: *Ešte raz navštíviť Železnú studničku* [*To Visit Železná studnička Once Again*] (directed by Imrich Jenča), Candoni: *Hlma* [*Mist*] (directed by Eva Galandová), Repka: *Chcieť istotu* [*To Want Certainty*], *Vtáci* [*Birds*], *Maximo* (directed by Vladimír Rusko sr.), Wilde: *Salome* (Vladimír Rusko sr.), etc.³²

The turn of the 1960s and 70s was marked by the invasion of the Warsaw Pact troops of Czechoslovakia, and a consequent turnaround in its politics to a totalitarian regime. This reflected also into the postulates of the doctrine of socialist realism in the spirit of the motto: "art belongs to the people". The course of the Avant-garde development of Slovak music was forcefully broken, several progressively oriented composers were expelled from the Association of Slovak Composers, and stopped composing; others (P. Faltin, L. Kupkovič, P. Šimai) emigrated. The tensed situation in the mid-1970s led to Peter Kolman, dramaturge of the *EXS* for many years, leaving Slovakia. The baton was picked up by composer J. Malovec (1976).

³¹ In 1968 and 1969, the following autonomous electroacoustic compositions were produced in the *EXS*: Peter Kolman: *D 68* (1968), *Motto non perpetuum* (1968); Jozef Malovec: *Punctum Alfa* (1968), *Tmel* [*Binder*] (1968); Ladislav Kupkovič: *Intermezzo 2* (1968), *Preparovaný text 1* [*Prepared Text 1*] (1968), *Preparovaný text 2* [*Prepared Text 2*] (1968), *Preparovaný text 3* [*Prepared Text 3*] (1968), *Preparovaný text 3½* [*Prepared Text 3½*] (1968), *Collage* (1968), *Vianoce* [*Christmas*] (1968), *Marceau de Genre* (1968), *Etuda* [*Study*] (1968), *Confessio* (1968); Roman Berger: *Elégia in memoriam Ján Růčka* [*Elegy In Memoriam Ján Růčka*] (1969); Ivan Parík: *Hommage to Wiliam Croft* (1969). In 1970 and 1971, the production of original electroacoustic works increased in the *EXS*: 8 autonomous electroacoustic compositions were concurrently produced in 1970 and 1971. The subsequent years brought a decline in original electroacoustic works due to the overall cultural and social situation: 3 compositions in 1972, 2 compositions in 1973, 4 compositions in 1974, 4 compositions in 1975. See ČIERNA, A.: Elektroakustická kompozícia na Slovensku. [Electroacoustic composition in Slovakia]. In: *Slovenská hudba*, Vol. 22, 1996, No. 1-2, pp. 67-111.

³² See RUSKO, V. sr.: Slovesná tvorba v Experimentálnom štúdiu [Verbal Production in the Experimental Studio]. In: *Slovenská hudba*, Vol. 22, 1996, No. 1-2, p. 124.

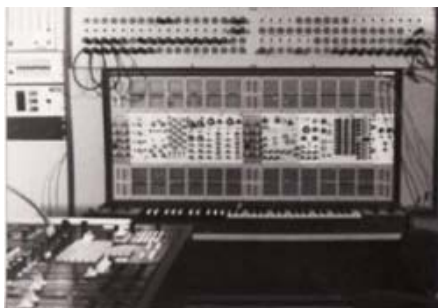
Figure 7: The Experimental Studio of the Czechoslovak Radio in 1968 (new premises).



Source: Archive of the EXS.

Paradoxically, in spite of the worsening political and social situation and its impact on musical culture, the first half of the 1970s saw an extensive development of Slovak electroacoustic music. The EXS headed systematically towards the technology of a semi-automatic control of the devices by voltage control, and to analogue programming. In 1971, an eight-track Studer A80/8 tape recorder was added to the technical equipment of the studio, and it became a source of a sophisticated technology of multitrack recording, and served as a basis for more perfect mixings. After 1972, however, an ARP 2115 synthesizer with a keyboard, which was partially programmable by a voltage control system of some of its modules, became the core technology of the EXS. Voltage from the keyboard, or through controlled generators, enabled the control of the frequency of the generators, the frequency limit of the filters, the speed of the steps of the sequencer, and other functions. The ARP 2115 synthesizer became the central device for the production of hundreds of radio programmes, and was also used for the production of electroacoustic compositions.³³

Figure 8: The ARP 2115 synthesizer in the EXS. Photo from 1985.



Source: Archive of the EXS.

8 The First Problems and New Initiatives

In the latter half of the 1970s, standardization had an alarming impact on the activities of the studio: financial funds for further development were cut, and the staff had to defend the meaningfulness and usefulness of this type of a studio within a public institution. By this time, the universal character of the studio had been definitely profiled. Besides the production of autonomous and incidental electroacoustic music, the work profile of the EXS included representative recordings of the folklore and the entertainment genre, the production of technically and artistically demanding musical and verbal programmes, programme jingles, sound effects and fillers, modifications of sounds, and the restoration of historically valuable archive recordings of musical pieces into a pseudo-stereophonic version. Moreover, they managed to secure regular

³³ Production by the EXS grew by new quadrophonic electroacoustic compositions and radio bands: *Vyznanie [Creed]* (directed by Vladimír Rusko sr., quadrophonic band, 1975), Michail Jurievic Lermontov: *Démon [Demon]* (directed by Viktor Lukáč, quadrophonic dramatization of the play, 1980), Tadeáš Salva: *Plač [Lament]* (electroacoustic radio opera, 1979). See JANÍK, 1989, p. 179.

programmes for electroacoustic music and performances of electroacoustic works in concerts and festivals, although with respective commentaries.³⁴ Under pressure from the management of the radio, the EXS had to change its name to a less "provoking" one in 1977: to Electroacoustic Studio (EAS), which remained its official name until 1990.³⁵ Autonomous electroacoustic music in Slovakia experienced a period of stagnation. In 1976, only two autonomous electroacoustic compositions were produced in the EXS, whereas not a single Slovak electroacoustic composition was produced in the EXS in 1977 and 1978. The invitation by the EXS was accepted only by German composer Lothar Voigtländer (*Structum I*). It was only in 1979 that Tadeáš Salva, who created the first Slovak electroacoustic radio opera called *Plač [Lament]* here, and also Roman Berger and Jozef Malovec, returned to the studio. Martin Burlas's composition *Hudba pre modrý dom [Music for the Blue House]* foreshadowed the emergence of a new generation of young composers.

Figure 9: Photo from the realization of T. Salva's radio opera *Plač [Lament]*. From left: Miroslav Vajdička (sound director), Sergej Kopčák (singer), Tadeáš Salva (composer); with their back, from left: Ján Backtuber and Peter Janík (sound engineers).



Source: Archive of the EXS.

In this difficult stage of its development, the international folklore competition *Prix de musique folklorique de Radio Bratislava* provided fresh impulses to the EXS. At the time, unconventional processing of authentic folklore by electroacoustic means was truly unique in the European region. Dozens of noteworthy compositions were born in the studio, and almost all the Slovak representatives of New Music took turns in their production. The compositions of Tadeáš Salva, a disciple of the Polish School of composers, and Svetozár Stračina, an ardent folklorist, deserve particular attention.

9 New Building: New Generation

At the turn of the 1970s and the 1980s, the team of the EXS was enlarged by sound engineer Juraj Ďuriš (1978, who later succeeded in composing electroacoustic music, too), and by Viťazoslav Kubička (1980), a representative of the emerging generation of young composers, who took up the position of dramaturge. The studio renewed contacts with abroad, revived the production of original electroacoustic compositions (presented also in concerts), and launched the production of programmes on experimental works, called *Hlási sa vám Elektroakustické štúdio [The Electroacoustic Studio Reports]*. An increased interest of the programme units of the radio in the activities of the studio manifested itself in its equipment as well. In the early 1980s, the studio acquired a Vocoder Sennheiser VSM 201,³⁶ a new Tesla ESR 1806 direction panel, several additional devices (modifiers) of its own make and ones made by the Research Institute of the Radio and the Television, and a new

³⁴ In 1977 a concert of electroacoustic music was included in the program of the Bratislava Music Festival and, in 1978 performances took place in Music Fund Slovakia. See JANÍK, 1996, p. 61 and BERGER, 1989, p. 118.

³⁵ After the 1989 change in the social and political situation, the studio returned to its original name, Experimental Studio (EXS). In: ČIERNA, 2012, pp. 165-182.

³⁶ Vocoder Sennheiser VSM 201 may be characterized as a set of filters on the basis of voltage control, which can be, for instance, even the human voice. An alternative source may also be selected, whose sound passes through these filters.

trick recorder, made by modifying a Studer A 80 tape recorder, which provided extended possibilities for speed regulation with lower fluctuation of speed.

In 1985, the *EXS* moved to the new building of the Czechoslovak Radio, where it received lucrative facilities: two production rooms, a recording studio, and a listening room. Now, it had digital synthesizers and multifunctional digital processors with a wide range of possibilities, while new technologies were used also in the field of modulation modifiers and correctors of the frequency progression.³⁷ The studio switched from the analogue system to a digitalization of all the elements of production: from recording, editing, cutting, up to the final mixing and reproduction. A new generation of Slovak composers, V. Kubička, R. Rudolf, A. Mihalič, M. Burlas, P. Machajdík, J. Vlk, P. Zagar, as well as visual artist S. Ilavský (1989), showed interest in working in its new premises.

Figure 10: From left: Juraj Ďuriš (sound engineer), Vítazoslav Kubička (dramaturge and composer), Ján Backstuber (sound engineer). Photo from 1985.



Source: Archive of the *EXS*.

The emerging generation enriched electroacoustic music by fresh perspectives on the message of the Moderne and the Avant-garde in the context of non-European musical styles (*minimal music, sound environment, meditative music, etc.*). It experimented with the visualization of the concert production, making use of light productions and *performance art; live performance art, sound sculptures, visual and kinetic performance art, etc.* came into being. Their entry widened the range of composers' poetics and, thanks to fusions with other genres of music (rock, alternative music), this type of music managed to arouse even the interest of young listeners. The young generation's works were in high demand even in international forums.

Figure 11: From left: Dušan Buchel (sound engineer), Martin Burlas (composer) and Juraj Ďuriš (sound engineer). Photo from 1989.



Source: Archive of the *EXS*.

³⁷ The new generations of digital processors enabled the equalization of the dynamics of the sound, adjustment of the acoustics, and shifting the sound along a stereobase. See JANÍK, P.: *Technické aspekty rozhlasovej tvorby v uplynulých desaťročiach činnosti rozhlasu na Slovensku* [Technical Aspects of Radio Productions in the Past Decades of the Activities of the Radio in Slovakia]. In: *Príspevky k dejinám rozhlasu 6*. Bratislava: Slovenský rozhlas, 2001, p. 31.

10 Post 1989

After the fall of the totalitarian regime in 1989, the production and presentation of electroacoustic music intensified. A return to its original name (*EXS*, 1990), the lively activities in the field of contacts with abroad, and the increased number of events, meant a new stage for Slovak electroacoustic music. After V. Kubička left the radio (1991), the artistic management was taken over for some time by J. Ďuriš, along with A. Zmeček, and new faces (R. Bartoš, E. Walzel, S. Kaclík, R. Sabo) gradually joined the team. The development of electroacoustic music in Slovakia intensified by the establishment of an association, the Centre for Electroacoustic and Computer Music (1992), with J. Ďuriš, Andrej Zmeček and Rudolf Žákovský as its founders.³⁸ The International Forum of Electroacoustic Music (IFEM '92) in Dolná Krupá³⁹, in which leading specialists and composers from Central European countries participated, was one of its first events. The IFEM '92 programme included a concert of the electroacoustic works of the participating authors, a seminar evaluating the historical development of EAM in the countries of the former Socialist Bloc, and the presentation of the first anthology of Slovak electroacoustic music published by the Slovak Radio in Bratislava. The forum became a platform for exchanging experience, information, contacts, as well as a room for projecting subsequent collaboration. IFEM '92 enlivened the interest in EAM in the Central European region and, a year later, as part of the 2nd year of the Melos-Étos international festival of contemporary music in Bratislava, there was a workshop and a concert from the production of a leading centre of EAM in Europe, the Institut de Recherche et Coordination Acoustique/Musique (IRCAM) in Paris.⁴⁰ The 2nd year of the international forum on electroacoustic music, IFEM '94, took place in 1994 and, in the following two years, the activities of the *EXS* in collaboration with the CECM extended to multimedia and interactive projects BEE95CAMP and BEE96CAMP, and two years of a Festival of Electroacoustic Music, FEM '95 and FEM '96, took place as part of the projects. Another festival of electroacoustic music took place in 1997. Besides the above projects, electroacoustic music was presented also as part of intermedia projects (SOUND OFF), interactive audiovisual installations (BIOFEEDBACK), multimedia performance art (...MEDZI...), and at an exhibition of graphics of electronic media (MEDIAGRAPHICS). There was more room for the presentation of EAM even among the programmes of the Slovak Radio. In 1992, the *Ex Tempore* programme began to be broadcast, and the radio recordings found their way, through international radio exchange projects within the European Broadcasting Union (EBU), even to the programmes of foreign radio stations. New members gradually joined the team of the *EXS*, enriching its production by new perspectives (sound engineers Robert Bartoš and Ernest Walzel, composer Marek Žoffaj).

11 The Sound Creation Centre and the *EXS*

Software (Alchemy, Sound Designer II, Samplacell II, MacMix, Performer), which brought a range of advantages like speed and precision in cutting and editing, the possibility of additional

³⁸ The mission of the CECM was to work "... with the historical legacy of electroacoustic activities, and to formulate history and presentation in this field, simultaneously, by targeted programmes." In: DUBOVSKÝ, R.: *Elektroakustická hudba na Slovensku* [Electroacoustic Music in Slovakia]. [online]. Originally available on <http://www.radioart.sk>, at present see www.sonicart.sk. [Retrieved on 11-06-2009.]

³⁹ The International Forum of Electroacoustic Music IFEM '92 took place on 5 Nov to 7 Nov 1992 in Dolná Krupá, and it included a seminar on the subject of the *Traditions, the Present, and Perspectives of Electroacoustic Music*, with the active participation of Dieter Kaufmann, Zoltán Pongrácz, Roman Berger, József Patkowskí, Lothar Voigtländer, János Decsényi, Hugh Davies, Gian Franco Maffina, and Rudolf Růžicka. The papers on the seminar were published in its proceedings, and were accessible also on the website <http://www.radioart.sk> [Retrieved on 11-06-2009] In: *Zborník medzinárodného fóra elektroakustickej hudby IFEM '92* [Proceedings of the International Forum of Electroacoustic Music IFEM '92]. Bratislava: CECM, 1993. At present, see www.sonicart.sk.

⁴⁰ The workshop took place in Studio 5 in the building of the Slovak Radio in Bratislava on 8 Nov to 11 Nov 1993, chaired by Xavier Chabot and Alexander Mihalič. The participants could learn not only about the activities and the structure of the IRCAM, but also about the latest software developed by this institute. The works of composers Yi Xu, Philippe Manoury, Frédéric Durieux, and Fabio Cifariello Ciardi were performed at the concert (10 Nov 1993).

corrections, a wider range of sound corrections and modifications, and flexibility, came to the forefront. Post 1997, however, room for electroacoustic music productions in the radio gradually began to narrow. The massive spread of computer technologies and the emergence of new private studios brought about a change in composers' attitudes to work in broadcasting media. This reality became a reason for the loss of the exclusive position of several experimental studios, which were forced to enrich their activities by new ventures (e.g. by the research and development of new technologies and software with an emphasis on organization, consultation and publication activities). Although the *EXS*, which experienced yet another change in its technological facilities (2001 to 2003), strengthened its position as part of a public institution, this did not last long. In 2006, for a short period, it became part of the Sound Creation Centre, which was to serve as a programme service for all types of programmes of the Slovak Radio.

Figure 12: Production Room A: *EXS*, 2001.



Source: Archive of the *EXS*.

Until April 2009, the Sound Creation Centre was headed by Juraj Ďuriš, who continued to participate in the realization of the progressive artistic and journalistic programme *Ex Tempore*, and in the dramaturgy, organization and realization of a series of concerts called *RadioART CONCERT*. The fact that the *Experimental Studio* suddenly disappeared from the organization structure of the Slovak Radio in Bratislava was symptomatic of the situation in the Slovak Radio at the time.⁴¹ The indifferent attitude of the management of the radio to the existence and activities of the oldest experimental studio in Slovakia, which was the only one to represent novel, progressive solutions to sound production in Slovakia, resulted in a gradual suppression of the production of autonomous electroacoustic compositions. In mid-2009, in its seventh meeting, the Radio Committee expressed its dissatisfaction with the activities and production work of the Sound Creation Centre. It criticized the one-sided focus of the centre on so-called online elements, and did not agree even with the planned closure of two production rooms, which "once..." formed part of "... the experimental centre".⁴² According to the Radio Committee, by the number of its jingles and spots, the production of the Sound Creation Centre was significantly shifting to commercialization instead of public service and a support of a modern perspective on broadcasting. Consequently, it may be observed that, similarly to the case of the Sound Studio of the Czechoslovak Television, the intensive experimental productions of this studio gradually became only tolerated rather than supported within the Slovak Radio (now called Radio and Television of Slovakia, RTVS)

⁴¹ See 2006 Annual Report of the Slovak Radio, Bratislava, April 2007, pp. 62-63.

⁴² In early 2009, four technical studios (in the form as they were established after its technology was revamped in 2001 to 2003) and nine employers (one of them external) formed the essence of the Sound Creation Centre. The former verbal director Peter Jezný criticized the activities of the new management of the SCC for its effort, as part of the new structure of the centre, "... to demolish the walls of the experimental studio". In: *Rozhlasová rada je nespokojná s Centrom kreatívneho zvuku*. In: *SME*, 15. 07. 2009. [online]. Available on: <http://www.sme.sk/c/4935410/rozhlasova-rada-je-nespokojna-s-centrom-kreativneho-zvuku.html>. [Retrieved on 14-06-2011.]

12 Epilog: A Change of Scene

EXS was looking for the meaning of its existence and the space for its activities and the fulfilment of new challenges. In 2013, *EXS* merged with the Academy of Performing Arts in Bratislava and found a new institutional umbrella.⁴³ The accent of its activities shifted to the field of education, and to scientific and research activities connected to the revitalization of monophonic audio recordings. However, artistic and concert productions of Slovak authors have remained in its portfolio of activities. Along with the other executive units of the Centre for Science and Arts of the Academy of Performing Arts in Bratislava, it became a centre for the management, coordination and programme conceptions of the publishing activities, artistic research and public presentation of the APA.

It is outright symptomatic that, through the *EXS*, Slovak electroacoustic music became yet again connected with film production, as it had been in the early development of the electroacoustic genre of music in Slovakia. The database of Slovak electroacoustic music in the APA was enriched by the creative contributions of newer and newer young generations of composers (including Marián Zavarský, Matúš Wiedermann, Matej Haász, Marek Kundlák, Martin Ožvold, Rudolf Pepucha, Marek Piaček and others) with a new attitude and perspective on the phenomenon of sound art. The attitude to the phenomenon of electroacoustic music is changing, and the compositional attitudes are changing as well. Real-time processions on concert stages came to the fore; music was increasingly combined with visual expression. Within new approaches and expressions, a wide live improvisation scene opened up, gradually replacing the "classical" composition of music on mg tape in a stone experimental studio.

However, the active cooperation between *EXS* and the Academy of Performing Arts did not last long, despite the efforts of the parties involved. This is also evidenced by the new *Organisational Regulations of the Centre for Arts and Science of the Academy of Performing Arts in Bratislava*⁴⁴ of 4 December 2020, where the *EXS* is no longer located. What was behind the cancellation of the cooperation? It can be assumed that, on the one hand, there were ideological contradictions in the views on the content of the activities of the *EXS* on the premises of the Academy of Performing Arts and, on the other hand, the economic difficulty of running the *EXS* on campus. In any case, despite the efforts of those involved to harness the creative potential of this progressive workplace, the *EXS* was once again left without an institutional umbrella.

The *EXS* has never shunned new initiatives. Ever since its beginnings, its activities were of a wide range, and the new findings and initiatives from the various fields of its activities enriched and widened also the range of possibilities and approaches to electroacoustic music. The achievements of the *EXS* are documented not only by awards from Slovakia and abroad (Dartmouth College, USA, 1968; Bourges, France, 1974, 1975, 1976, 1992; Varese, Italy, 1979, 1980, 1981, 1985, 1987, 1990, 1991; Stockholm, Sweden, 1988; Aarhus, Denmark, 1992; Prague, Czech Republic, 1994), but also by its discography. Besides early

⁴³ See the *Organization Plan of the Centre of Arts and Science of the APA in Bratislava* from 13 March 2013, as well as the original *Framework Agreement on Collaboration* between the Academy of Performing Arts and the Radio and Television of Slovakia, which proclaims the scientific, research, consultation and education activities of the *EXS*. At the same time, the agreement binds the *EXS* to take care of the obsolete but historically valuable electroacoustic devices which had lost their function at the RTVS but, within the APA, they serve for teaching and research. An annex to the agreement is a contract on the lease of technological equipment (an EMT gramophone, Revox A 700, Studer A 80/RC and Studer A 812 tape recorders, a 5X 90 II reverberator, an ADR digital modifier, Kurzweil and Yamaha synthesizers, and an expander amplifier compressor).

⁴⁴ See Article 3: Scope of Activities and Organisational Structure, point 4: In the organisational structure of the Centre for Arts and Science of the Academy of Performing Arts only: a) the Institute of Theatre, Film and Music Theory and b) the Section of Editorial Activities remained. [online]. Available on: https://www.vsmu.sk/wp-content/uploads/2022/01/Organizacny_poriadok_CUV_VSM_U_2020_11_FINAL.pdf [Retrieved on 29-06-2023.]

recordings on LPs⁴⁵, these include also recordings on CDs: R. Berger's *De profundis* (Music Fund, SF 0012 2131, 1993), M. Bázlik's *Spektrá [Spectra]* (Slovart Records SR 0033, 1999), and recordings from the production of the CECM and the Radio Bratislava label.⁴⁶ Recent additions to the discography of the production of the EXS is an edition of three LPs/CDs: *Experimental Studio Series 1-2-3* (2014/2015), which presents a cross-section of the development of the EXS, and of Slovak electroacoustic music, from the beginnings of experimental team productions up to contemporary audio manifestations. That is why the three storage media bear the titles *Different Music*, *New Generation*, and *Live Stages*.

In spite of the peripeteias and numerous traps of the sudden boom of computerization and information globalization, which several experimental studios on the academic, public and private commercial scene succumbed to, the EXS activity has continued unabated in the second decade of the 21st century. Similarly to other entities, EXS has also moved part of its activities to the virtual environment of the Internet alongside its concert activities. With a new logo and a new website (<http://www.son.icart.sk>), EXS promotes and showcases electroacoustic music across the full breadth of historical and contemporary genres of sound art. Examples of recent EXS projects include *Imago Sonoris – Art's Birthday 2023* (Radio Devín, Euroradio EBU, radio internet stream, 17.1.2023), *Imago Sonoris/Lost Time?* (A4/Associations for Contemporary Culture, Bratislava, 9.11.2019), *IFEM 2019/International Festival of Experimental Music* (A4/Associations for Contemporary Culture, Bratislava, 21.-22. 6. 2019), *Electroacoustic Music from Six Decades* (EOA Concert, 7.7.2018), *IFEM 2018/International Festival of Experimental Music* (Slovak Radio, Bratislava, 23.-24.3.2018), *Vae Victis – division into unequal parts* (Ostrava, 17.1.2018), *Bonsai Garden – dedicated to Milan Adamčík* (Kino Cineport Ostrava, 17.1.2018) and many other.

Although one of the features of the development of Slovak music in the 20th century is a certain developmental lag behind European music, in the case of electroacoustic music (despite the unfavourable cultural and political situation at the time of its birth) it is only a minimal time shift. Already at the end of the 1950s, the first electroacoustic compositions were created in the domestic environment (R. Berger, I. Zeljenka, P. Šimai). In the same period, thanks to I. Stadtrucker, the Sound Department of the Czechoslovak Television in Bratislava was established, and soon the Experimental Studio of the Czechoslovak Radio in Bratislava was formed under the leadership of P. Kolman. Thus, already in the first years of its existence, the generation of the young Slovak musical avant-garde of the 1960s gained favourable technical conditions for the creation of "other music". However, it was not an easy path and the changes and development lines outlined only partially outline the peripeteias of Slovak electroacoustic music. For some composers, the electroacoustic medium lost its appeal over time, while others explored its possibilities throughout their lives. And although today the technical possibilities have advanced by leaps and bounds, the idea of creating music based on the acousmatic perception of sound phenomena obtained through technology is still alive – whether in the form of electroacoustic music, RadioArt, SonicArt or Ars acustica.

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⁴⁵ Electroacoustic compositions by J. Malovec and I. Zeljenka on Supraphon DV 6221 LP from 1966, J. Malovec's composition *Orthogenesis* on Turnabout-Vox 34301 LP from the year 1968.

⁴⁶ See CD recordings by the CECM Bratislava EM CD 001 and 002 from 1992, with compositions by J. Malovec, P. Kolman, M. Bázlik, I. Parík, R. Berger, M. Długosz, J. Đuriš, L. Voigtländer, V. Kubička, T. Salva, M. Burlas, and CECM Bratislava EM CD 003 from 1994 (P. Zagar, M. Piaček, J. Đuriš, M. Bázlik, R. Rudolf, V. Kubička, R. Berger). Also, Rádio Bratislava CD Exeditions 5 (M. Bázlik *Epoché*, T. Salva *Pláč [Lament]*) and CD Exeditions 6 (J. Malovec, R. Pepucha, N. Uličná, V. Parobková, V. Kubička, M. Krajčí).

THE IMPACT OF A PARENT'S INCARCERATION ON A CHILD IN CARE: A QUALITATIVE RESEARCH STUDY

^aALOIS DANĚK

Jan Amos Komenský University Prague, Department of Special Education, Roháčova 1148, Prague, Czech Republic
email: *danek.alois@ujak.cz*

Abstract: Incarceration has a significant impact on many areas of the imprisoned person's life. The incarcerated person's family is also severely affected. The children of these families in particular are the ones who carry significant and profound traumas into their lives. Some children live in an institutional setting, which is also a fact that causes trauma. In this paper, we will focus specifically on the impact of a parent's incarceration on a child growing up in a children's home. Using a qualitative research design, we sought to identify the areas most affected by a parent's incarceration. We found that the social competencies of the children studied were the most affected. Based on our results, we will recommend modifications to the educational process in children's homes.

Keywords: Imprisonment, Children's Home, Inclusion, Aftercare, Psychological Deprivation, Institutional Education

1 Introduction

Parents are the most important people in a child's life. The imprisonment of a parent has a severe impact on his or her child. In this paper, we will focus on a specific group of children. Not only do they have the experience of having a parent in prison, but they are also affected by the fact that they live in an institutional setting. The main aim of this paper will be to find out what areas of the life of the studied group of children have been affected by the incarceration of the parent. In this paper, we will first describe the theoretical background, the methodology used and introduce the researched environment. We will then present the process of the research and we will discuss the important findings. The results of the research showed that the impact of a parent's incarceration on a child is devastating. Based on the research findings, we will offer suggestions for modifying special educational practices in children's homes. We will point out the need for an interdisciplinary approach across all the departments involved.

2 Theoretical background

In modern democratic society, the question of the influence of a parent's imprisonment on a child is often raised (cf. Dadič et al. 2023; Davis et al. 2011). In the Czech Republic we must mention the important works of Jůzl (2012), who laid the foundations for the modern Czech resocialisation and penitentiary science. The issue of the impact of parental incarceration on the child has recently begun to attract the attention of Czech experts. For example, we can mention the ongoing project realized by Masaryk University Brno "Parenting Behind Bars", which has produced excellent publications (cf. Punová, 2020; Horová, 2021; Navrátilová et al., 2015). The impact of a parent's incarceration on a child is a very complex issue (Cui et al., 2023), so this area must be addressed with interest by the scientific community. Regarding the issue of Czech institutional education in our research, we draw on the author's previous research. The interdisciplinary nature of the problem of incarceration is also dealt with, among others, by Stárek and Víšek (2022).

3 Research methods

The research design used for the presented study has proven successful in our previous research (Daněk, 2021). This research design is based on a combination of interviews, long-term observation and analysis of pedagogical documentation. We use unstructured interviews. They allow us more freedom in asking questions depending on the actual respondent's situation (Brinkmann, 2023). The observations take place during the standard operation of the observed children's home. Of particular interest is the access to the pedagogical documentation of the children's home, which is unavailable to other researchers. The

information obtained is then further processed using grounded theory and interpretative phenomenological analysis. We continuously enrich our research design with new research methods in order to avoid the research routine. We tailor the research design to the needs of the target group. Elements of narrative analysis, which can be understood as our interpretation of the stories we collect from the individuals present in the research setting, have proved useful in recent research, thus reconstructing the construction, retelling the narrative (Riháček et al., 2013, p.75).

We benefit from the presence of the researcher in the researched setting; the author is employed in the researched children's home as an educator and prevention methodologist. The children and young adults approach the author as a member of their social structures, which proves to be quite crucial for establishing a quality research contact (Charmaz, 2006, p. 5). In several research experiments conducted, we found that children and young adults modify their responses according to the researchers' expectations (Daněk, 2022). As part of the environment under study, we have a greater opportunity to capture reality. However, we are aware of the danger of confirmation bias that could occur through a biased approach. We, therefore, submit our research results for review by experts with no connection to the research setting (Flick, 2009). While qualitative research provides deeper insight into the problem under study, the results cannot be presented as universally valid. They are valid only for the research setting, for the researched group, and for a clearly defined space-time. Qualitative research makes a significant contribution to inclusive education (Willig, 2017).

4 Researched environment

We are conducting a longitudinal study of a children's home in Prague, Czech Republic. A children's home is a school institution for the performance of institutional care. Institutional care is ordered by a civil court in case the child's family is unable to fulfil its responsibilities (Czech Republic, 2012, § 971). The children's home is intended for children and young adults without serious behavioral disorders (Czech Republic, 2002, § 12). This does not mean that the population of children's homes is exempt from problems. The children come exclusively from families that can be described as significantly pathological. We have documented cases of violence, neglect, alcohol, drugs, and abuse (cf. Blažek et al, 2019). This is just a cross-section of the range of negative exposures to which the children have been exposed for a long time. According to our information, the standard duration of pathological influences before the intervention of the social protection authority is approximately five years.

Furthermore, it is necessary to point out that the vast majority of the children in the research have had at least one stay in a facility for children in need of immediate assistance or another form of foster family care. Thus, institutional care was ordered only when the child welfare system failed to rehabilitate the disrupted family and no alternative family care was available for the child. It is clear that all the children came to the children's home severely emotionally deprived. In a large part of these children, we can observe manifestations of CAN syndrome. Children in the children's home can be identified as children with special educational needs. On the basis of our previous research, we can say that the greatest deficits can be observed in the area of social competences. Although the preferred narrative at present is that of the uninspiring nature of institutional care, our results from earlier research confirm the need for a state-guaranteed safe environment for such children for whom it is not possible to offer an alternative in the form of foster family care (Daněk, 2022).

5 Research results

We began working on the question of the impact of parental incarceration on a child in the children's home in January 2022 and concluded the research in April 2023. The research was conducted during the normal operation of the children's home, which allowed us to spend a massive amount of time with respondents. The structured research design proved successful. We start with a pre-survey, where we select suitable respondents based on pedagogical documentation. For this research, we selected two young girls, aged 19 and 20, who have a father in prison. The primary research question was how parental incarceration affects the respondents' bio-psycho-social ecosystem. The girls' fathers are repeat offenders with long sentences. The exact offences were not known to us. However, from in-depth interviews, we found that both fathers had been repeatedly punished for violent crimes. They should be released within two years. We monitored the girls' reactions after the phone calls and discussed the content of their correspondence with the girls. Everything was done with respect to the privacy of all participants and, of course, consent was obtained to conduct the research.

Both fathers say how much they care about their daughters' future. They often write letters, phone their daughters and take the opportunity for their daughters to visit them in prison. The girls see the prison visit as an obligation to their father. In addition, both send their fathers permission slips, which they fund from pocket money and income from part-time jobs. The girls talk about how they will live with their fathers upon release and build new families, suggesting a major problem for the future. The family is the most important social factor in which a child forms patterns of behaviour. It is the family that can become a risk factor for the development of behavioral disorders if various pathologies are present. We are talking about cases when patterns of antisocial or antisocial behaviour are present in family members (Blažek et al., 2019, p.30). The family is also traditionally considered to be the main factor that, through its failure, enables children to engage in criminal behaviour (Sychevová and Halířová, 2014, p.121). It is clear that children of incarcerated parents are at increased risk of developing undesirable behavioral patterns (Davis et al, 2011, p.177).

Furthermore, the economic sphere should also be highlighted. Incarcerated parents are unable to be economically active while accumulating fines and penalties on their debts. When they return from prison, their criminal record makes it difficult for them to re-enter the labour market (Turney and Goodsell, 2018, p. 149). When we consider that daughters will be forced to cope with their own difficulties in integrating into intact society after leaving the children's home and, in addition, the burden of caring for their fathers when they return from prison, we see a significant problem here. Respondents identified the enormous stress that their fathers' incarceration placed on their extended families (Raikes, 2016).

Although we noted we noted a tendency of respondents to relativise the incarceration of a parent, both respondents felt this to be a significant social stigma. One respondent is being monitored by a psychiatrist. She clearly identified the fact that her father is unable to fulfil his parental responsibilities as one of the causes of her psychological problems. The girl spoke of traumatic experiences of visits to prisons.

A major finding of our research concerned the social lives of the respondents. They could not establish any partner relationship during the entire period of the presented research. When interviewed on the topic of partnership, both respondents gave vague and evasive answers. Here we see the influence of disrupted parental attachment. Both respondents pointed out that it is very difficult to trust potential partners when their own fathers have disappointed them. Both respondents turn to social networks and try to satisfy their need for socialization in the virtual world.

6 Conclusion

Parental incarceration has a severe impact on the child and negatively affects many areas of the life of the child (Martin, 2017). We observed an impact on the psychological well-being and on the social competence of the children studied. It is important to note that the respondents we observed are not only at risk of the negative impact of parental incarceration but also the fact that their living environment is an educational institution (Drahý et al, 2018, p.86).

A problematic issue for our research was the lack of detailed information about parents' criminal activity. An intervention in special education needs accurate information, otherwise it won't be able to achieve its goals. However, there is no statutory obligation for individual departments to share information. We believe that interdisciplinary cooperation will necessarily need to be strengthened. The ministries of justice, education, social protection, and health must join forces and start effective cooperation together. Social workers will also play an important role in the prison space (Stárek and Víšek, 2022). Inter-agency teams could be a tool to improve the effectiveness of work with children and young adults who have experience with a parent in prison. These teams should include a special pedagogue for behavioral disorders, an etoped, who has the skills to deal with challenging situations (Žolnová, 2018, p. 101). There will also be a need to enrich the curriculum preparing educators in residential care institutions with knowledge of resocialisation and penitentiary issues (Allard and Green, 2011, p. 8).

Based on our findings, a demand should be made to build a quality aftercare system that offers professional counselling and psychotherapeutic support, especially in the form of family therapy programmes. Here we see great opportunities for the involvement of the non-profit sector, which has the potential to play an important role in emergency situations (Stárek and Zpěvák, 2023). Furthermore, the possibilities of technological progress need to be exploited. We see the possibilities of integrating modern information technologies into the educational process as beneficial (Osvaldová, 2015, p. 202). Modern communication channels could facilitate more intensive contact between the incarcerated person and his/her family members. Case conferences involving the convicted person, their child in the children's home and a psychologist or social worker could be very beneficial. The advantage of such conferences should be better psychological well-being of the child in the children's home. It would also improve the convict's preparation for contact with the child after release from prison.

We are convinced that children in care with experience of parental incarceration are among the hardest hit, most vulnerable group. Society needs to realize that the issue of parental incarceration has a greater impact on these children. They require maximum support and a professional approach from the professionals involved. It is therefore essential that the education and training of educators in children's homes be enriched with knowledge of resocialisation and prison issues. In this way, it will be possible to meet the needs of children who experience the comorbidity of trauma caused by the incarceration of their parents and are also exposed to the influence of the institutional environment.

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THE PERCEIVED ATTRACTIVENESS OF SEXUAL DIMORPHIC FEATURES IN MALE FACES ACROSS THE LIFESPAN OF A WOMAN

SLAVKA DEMUTHOVA

University of Ss. Cyril and Methodius in Trnava, Nam. J. Herdu 2, 917 01 Trnava
email: slavka.demuthova@ucm.sk

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Abstract: According to evolutionary psychology, the presence of masculine sexual dimorphic traits is an indicator of the hidden qualities of the organism. On the other hand, it is also characteristic of men with low levels of warmth, honesty, and a reluctance to invest in offspring. As female reproductive goals vary across a woman's lifespan, changing from finding the best donor of "good genes" to a commitment to a "selfless caregiver", it is probable that the attractiveness of masculine/feminine facial features in male faces changes across a lifespan. The results of the study indicate that the degree of preference for masculine male faces increases from their teens, reaches a maximum during the period of reproduction before marriage and decreases in older age, with a statistically significant decrease in the postmenopausal period.

Keywords: Attractiveness, male face, sexually dimorphic features, age.

1 Introduction

The attractiveness of another person is a multidimensional and complex phenomenon that is comprised of numerous social (Ha et al. 2010), cultural (Voegeli et al. 2021), ontogenetic (Salehi et al. 2019), gender (Palumbo et al. 2017), and other variables. In its essence, the phenomenon of human attractiveness is linked to biological mechanisms (the activation of the reward systems in the brain, including the amygdala, insula, and limbic system – Pitcher et al. 2011) and stems from evolutionary pressures, through which our psyche has been shaped over hundreds of thousands of years. A whole complex of changes (the activation of reward centres in the brain, the presence of positive emotions, the tendency to prefer one individual over another based on visible characteristics etc.) covered by the umbrella term attractiveness occurs in an individual as a reaction to the presence of specific, visible features of another person. This preference in the appearance of another person is the result of evolution (Demuthova et al. 2019) – such links have formed because these characteristics turned out to be markers of the hidden qualities of the other person which allowed them to better secure their survival – whether by gaining access to food resources (natural selection) or the successful reproduction of their genes through their offspring (sexual selection). These visible characteristics include, for example, a narrow waist and wide hips in women (the WHR ratio, which highly correlates with a woman's fertility), larger jawbones, thinner lips and cheeks in men (features of masculinity, which correlate with high levels of testosterone – Penton Voak & Chen 2004) or facial symmetry (as a signal of developmental stability – Simmons et al. 2011).

Every feature/characteristic, which is considered to be attractive, has its traces linked to a hidden quality that provides evolutionary advantages. Humankind "learned" to identify these advantages through external features and their preference is reinforced by the activation of the reward centres and is accompanied by a positive experience for the observer (the feeling of attractiveness). It is a matter of discussion whether the evolutionary mechanisms of the preference for a partner that are accompanied by an experience of attractiveness are still important today, when our survival and number of children no longer depend on the fitness of the individual. It is true that stronger phenomena have appeared in the post-industrial society, including the compatibility of values and interests, trust, providing support, mutual understanding, faithfulness, responsiveness... (Canevello & Crocker 2010; Laborde et al. 2014; Lopes et al. 2017), which have a dominant impact on who we prefer in a romantic relationship; however, it should be noted that we are still influenced by evolutionary mechanisms of preference. They are particularly strong in the initial phase of interpersonal interactions, when a primary "filtering" stage occurs – we filter out those whom we like and whom we find

attractive, and thus if we are willing to interact or not. The human face appears to be especially important in this context, since (as opposed to the body) it is uncovered and therefore it allows us to read the important features/signals more quickly and more accurately.

Many studies highlight that we are still highly sensitive to specific features (signals), and we consider faces with these features to be attractive – without even realising these features are present and that we have a preference for them. In this regard, several features are considered to be attractive, for example, symmetry, averageness or neoteny (Rhodes et al. 2001; Little et al. 2011a; Kočnar et al. 2019). Another major feature is the presence of sexually dimorphic features (Foo et al. 2017; Mogilski & Welling 2018). Feminine features such as high eyebrows, gracile jaws and fuller lips, a smaller lower part of the face and a relatively flat mid-face (Penton-Voak & Perrett 2000; Little et al. 2011a) indicate the health and fertility of a woman to men (Gray & Boothroyd 2012; Little et al. 2014); masculine features such as wide faces with large and massive lower faces, thinner cheeks and lips, a wide inter-orbital distance and a wide nose (Mitteroecker et al. 2015; Little et al. 2011a) correlate with a high level of testosterone which is crucial for spermatogenesis (Foo et al. 2017).

2 Problem

While men's preference for feminine faces is relatively stable and universal (O'Connor et al. 2013; Little et al. 2014; Demuth & Demuthova 2017), female preferences for masculine features in a male face have been associated with diverse results. Some studies have confirmed a high degree of preference for masculine features (Rennels et al. 2008), while others have confirmed a preference for feminine (Burriss et al. 2014) features in a male face. There are also results that state that facial dimorphism has no significant influence on any of the measurements of attractiveness (Muñoz-Reyes et al. 2015). However, more detailed analyses have shown that the different results in the preference for masculine and feminine features in male faces may depend on the presence of other factors that modify these preferences. These include mate selection strategies of women (Holzleitner & Perrett 2017; Ekrami et al. 2021), hormonal activity during the menstrual cycle (Peters et al. 2009), the type of relationship that the woman wishes to enter (Soler et al. 2012), their financial situation (Marcinkowska et al. 2019) and others.

In the context of evolutionary impacts, the age and ontogenetic phase of a woman's life appears to be important. It may be assumed that during the period of fertility (the phase of life when a woman is planning to reproduce) a woman will look for partners with the genes that give the best chance for the survival of her offspring – she will focus on dominant, ambitious and aggressive men who are characterised by high levels of testosterone and thus have masculine facial features (Little et al. 2015). Dominance (Ahmetoglu & Swami 2012) or aggressiveness (Little et al. 2015) equals better success in gaining resources and a higher social and economic status (Gouda-Vossos et al. 2019). However, a high level of masculinity results in low levels of warmth and honesty (Fink & Penton-Voak 2002), which are not advantageous characteristics for a long-term partner that will take care of offspring. There is also evidence that males with masculine features are relatively less likely to invest in offspring (Penton-Voak et al. 2003). The above-mentioned data gives us reason to believe that a woman in the phases of mate selection and the period of upbringing will, on the contrary, tend to prefer individuals with a high degree of feminine features and consider them to be more attractive. These features are connected to characteristics such as warmth, faithfulness, willingness to help, etc. that are valued in a long-term relationship (Gangestad et al. 2007). In the light of the above assumption, we expect that female preferences for

masculine and feminine features in the assessment of the attractiveness of a male face will differ in the individual phases of life bound to reproductive functions.

3 Objective

The main objective of the paper is to explore the attractiveness of masculine features in male faces by women in various periods of their lives over their lifespan.

4 Method

4.1 The Presence of Sexual Dimorphic Features

For the study of the attractiveness of sexual dimorphic features present in a male face we used a computerised facial composite with two different versions – one with a high level of feminine facial features (Figure 1A) and one with a high level of masculine (Figure 1b) facial features. The advantage of working with digital facial composites is that a computer-generated male face (which does not belong to any specific person) can be digitally modified to exhibit specific desired characteristics. Studying facial attractiveness is therefore conducted as a kind of experiment – the subject is exposed to two identical impulses (elimination of undesirable variables) that only differ in terms of the presence of masculine/feminine features (independent variable). If the subject evaluates one of the faces to be more attractive (dependent variable), it shows that the preference is exclusively caused by the presence of specific facial features (feminised or masculinised face). The impact of other characteristics that might be present in natural (real) faces and might therefore influence the individual assessment of attractiveness is thus controlled (eliminated).

Figure 1. Male facial composite with a prevalence of masculine (left) and feminine (right) features



Source: Little et al. (2011a, 1642).

4.2 Developmental Periods

Given the assumption that a preference for masculinity is linked to the reproductive behaviour of a woman, six periods of life were specified:

1. The pre-coital period (≤ 16 years old). According to Slovak statistics (Markova et al. 2019) the mean age of the first experience of sexual intercourse is at 17 years of age. For this reason, the first period ended at the age of 17, in which case we assume that the majority of the sample has not yet experienced sexual activity.
2. The exploration period (17 – 24 years of age). After the start of a sexually active life, most young adults go through an orientation phase, in which they not only explore their own sexuality but also form an idea about their desired future life partner through relationships with people of the opposite sex. The beginning of this period is set at the beginning of a sexually active life (at 17 years old) and it ends at the age when non-binding exploration changes to the phase of searching for an intimate partner (24 – 25 years of age).
3. The period of searching for a mating partner (25 – 30 years of age). During this period, women focus on relationships that potentially present mating relationships. We assume that this period may begin at approximately the age of 25 and the upper limit is set at the mean age for the marriage of women (31 years old – Podmanicka 2019).
4. The period of marriage (31 – 40 years of age). During this period women create and try to maintain the long-term relationships in marriage (or as a family). On one hand, most women give birth during this period and on the other, they tend to make and keep the relationship with the partner who helps them to raise the offspring.
5. The period of childcare (40 – 50 years of age) is a period of ontogenesis, during which women are still fertile from a biological perspective, but most women focus on raising children and ensuring the success of their children rather than on procreation.
6. The postmenopausal period (≥ 51 years of age). Menopause (which starts in Slovak women at a mean age of 51 – Kristalyova 2020) means the end of female fertility, after which a woman cannot conceive a child through natural means.

4.3 Subjects

The data was obtained from 1,293 Slovak female subjects aged 11 to 77 (mean age = 24.14; std. dev. = 10.591). The numbers of subjects in the individual age groups are presented in Tab. 1.

Tab. 1. Age specificities of the subjects according to the periods of life

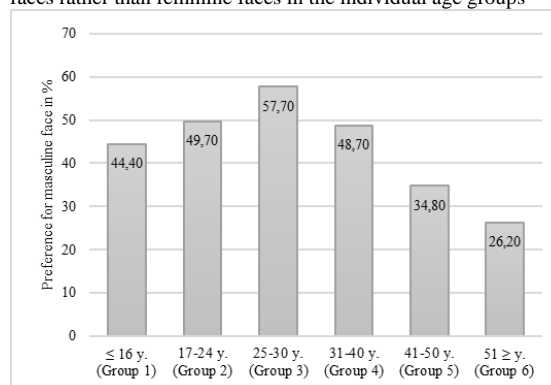
Group	1	2	3	4	5	6
age	(≤ 16)	(17–24)	(25–30)	(31–40)	(41–50)	(≥ 51)
N	9	998	78	78	69	61
Mean	13.22	19.54	27.15	35.36	45.46	52.87
Std. Dev.	1.986	1.675	1.802	2.963	3.061	6.857
Minimum	11	17	25	31	41	51
Maximum	16	24	30	40	50	77

Source: Author.

5 Results

The results (Figure 2) show that the preference for masculine features in male faces increases from the teenage years and reaches a peak at the age of 25 – 30, when the majority of women searches for an intimate partner, yet without a commitment (marriage) so far. It is during this period that masculine male faces are considered to be the most attractive – they were preferred by the majority (57.7%) of subjects of this age (as opposed to feminine faces). Then the preference for masculine features decreases (to 48.7% for the 31 – 40 age group and further to 34.80% for the 41 – 50 age group). After menopause, most women (73.80%) consider feminine male faces to be the most attractive.

Figure 2. Percentage of women that preferred masculine male faces rather than feminine faces in the individual age groups



Source: Author.

Given the high number of comparisons and the effort to eliminate type 1 errors, an ANOVA was used to compare the preference for masculine faces among five age groups. The output values of the analysis ($F = 4.155$; sig. $<.001$) indicated that women significantly differ in their preference for masculine male faces depending on their ontogenetic period. Subsequently, a Post Hoc Test for multiple comparisons of facial composite preferences among individual groups of women showed (see

Tab. 2) that statistically significant differences are present in postmenopausal women (group 6) compared to women aged 17-24 years (group 2) and to women aged 25-30 years (group 3).

Tab. 2. Multiple Comparisons of age groups in the preference for masculine facial features (Post Hoc Test)

Sample A – Sample B	Mean Diff. (A-B)	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
1 – 2	.053	.176	1.000	-.59	.69
1 – 3	.132	.184	.975	-.51	.78
1 – 4	.043	.185	1.000	-.60	.69
1 – 5	-.097	.185	.994	-.74	.55
1 – 6	-.182	.185	.912	-.83	.46
2 – 3	.080	.058	.747	-.09	.25
2 – 4	-.010	.059	1.000	-.18	.16
2 – 5	-.149	.060	.139	-.32	.03
2 – 6	-.235	.059	.002**	-.41	-.06
3 – 4	-.090	.080	.872	-.32	.14
3 – 5	-.229	.081	.057	-.46	.00
3 – 6	-.315	.080	.002**	-.55	-.08
4 – 5	-.139	.081	.522	-.37	.09
4 – 6	-.225	.080	.064	-.46	.01
5 – 6	-.086	.081	.898	-.32	.15

Note: **p ≤ .01

Source: Author.

6 Discussion

6.1 Interpretation of Results

The results obtained should be interpreted in the context of the various reproductive strategies adopted by women. They are based on the assumption that women must invest significant effort into pregnancy, childbirth, lactation and upbringing (as opposed to men who only have to contribute sperm for successful reproduction). In order to maximise reproductive success (with the production of the highest possible number of children), men use as many opportunities as possible (Cornwell et al. 2006), while women have to face the decision of which reproductive strategy to use. On one hand, it is advantageous for them to choose genetically apt, masculine partners, who donate "good genes", but they tend to be less willing to make an investment in parenting, in commitments and are more promiscuous. On the other hand, feminine men tend to be more willing to make long-term commitments and take care of the family, but have lower-quality genes.

Clearly, many factors have an impact on the choice of female strategy for mate selection – starting from the menstrual cycle phase (Gildersleeve et al. 2014), the length of the planned relationship (Little et al. 2011b), their own attractiveness (Cornwell et al. 2006), up to the decision to have or not have children (Watkins 2012). In spite of the possible interference of these variables, the assumption that women use the strategy of the selection of a donor of good genes in the fertile phases of life and prefer a caring partner during the periods of their life when they form long-term relationships has been confirmed. From all of the age groups, the highest level of perceived attractiveness of masculine facial features was present in the 25 – 30 followed by the group of 17 – 24 years old females. These are age periods during which women are biologically best prepared for reproduction, and therefore, it can be assumed that evolutionarily conditioned tendencies to prefer partners with good genes and fitness (and thus with masculine facial features - Prokosch et al. 2005) will be highest. By selecting an appropriate partner, the mother increases the probability that her offspring will survive and preserves her genes by ensuring her children possess successful, good genes.

Although reproduction continues after this period, the strategy of seeking a "caring partner & a good father" becomes more dominant, as shared parenting becomes very important during this time. From statistics, it can be inferred (see the Statistical Yearbook of the Slovak Republic 2022) that the highest number of women give birth to their children at the age of 30-34 years, which explains the decrease in interest in masculine faces during

this period. Instead, a preference for feminine male faces reflecting characteristics such as warmth, faithfulness, willingness to help (Gangestad et al. 2007), and higher investments in offspring (Penton-Voak et al. 2003) emerges. The female preference for masculine features rapidly decreases with fertility decline. The lowest level was found in women at an age of 51 and above, with the decrease being reflected in the statistically significant difference in the preferences for masculine features in this group as opposed to the younger age groups (17 – 24 and 25 – 30). Similar results were also found by Vukovic et al. (2009) – they discovered that the preference for digitally masculinised male faces decreases as a result of hormonal level changes in women aged 40 to 64. Once women reach menopause, they not only experience a reduction in fertility, but also in their sexual desire (Bancroft 2002), which is why they prefer long-term rather than short-term relationships (and prefer feminine partners). Since women are infertile after menopause, their sexual activity has no impact on reproductive success. This means that natural selection no longer creates any pressure on their preferences related to the selection of a partner (Kościński 2011). However, women after menopause may benefit from friendship with a man who is willing to take care of them and their children, which may explain a preference for feminine features in male faces that signal desirable characteristics in a man (e.g., faithfulness, caring nature, empathy).

6.2 Limits and Suggestions for Further Research

The first problem that occurred in the processing of the data was the disproportionate representation of participants in the individual age groups. After the individual groups were formed based on life periods, the first age group (up to 17 years of age) only included 10 women, while the second group (17 – 24 years of age) consisted of 964 participants. The numbers were relatively well balanced in the remaining groups (around 60 participants). To improve the validity of the results, it could be beneficial to collect additional data for the age groups with a smaller number of participants. Research dealing with preferences for sexually dimorphic facial features demonstrates that when selecting one of two strategies (the "donor of good genes" vs "caring father and partner"), several factors play a part – these include, as already mentioned, the ideal length of relationship (Little et al. 2011b), the phase of the menstrual cycle (Gangestad et al. 2007; Gildersleeve et al. 2014), the decision to have children (Watkins 2012) and others. Further research could therefore include these parameters.

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Primary Paper Section: A

Secondary Paper Section: AN

PERSONALITY AS A FACTOR IN THE LEARNING PROCESS OF TEACHING – THE CONTEXT OF THE BIG FIVE THEORY

^aJAKUB JERZY CZARKOWSKI, ^bJANKA BURSOVÁ,
^cEVA DOLINSKÁ, ^dVÁCLAV ŠIMEK, ^eDÁŠA
PORUBČANOVÁ

Academy Justice, Wiśniowa 50, 02-520 Warszawa, Poland,
Catholic University in Ružomberok, Faculty of Theology,
Hlavná 89, 041 21 Košice, Slovakia, Catholic University in
Ružomberok, Faculty of Education, Hrabovská cesta, 1, 034 01
Ružomberok Slovakia, Internal Security University in Lodz,
Prague workplace, Hovorčovická 1281/11 182 00 Praha 8,
Czech Republic, University DTI, Dubnica nad Váhom,
Sládkovičova 533/20, 018 01, Slovakia
email: ^a*jakubczarkowski@gmail.com*, ^b*janka.bursova@ku.sk*,
^c*eva.dolinska@ku.sk*, ^d*vsimek@seznam.cz*, ^e*porubcanova@dti.sk*

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Abstract: The five-factor model of personality, popularly known as the Big Five, is a simple yet universal model of personality structure that defines five basic personality traits: extraversion, neuroticism, conscientiousness, agreeableness and openness to experience. The personality dimensions specified in the Big Five model allow describing the set of human behaviours, including learning and teaching. Regarding the organisational behaviours, including the managerial ones, the Big Five descriptors are recognised prognostics of behaviours at work. This may also be the case in the area of behaviours related to education and the learning-teaching process. Characterizing educational behaviour based on the model of five traits enables determination of the desired personality profile in a learning situation and will allow for the conscious shaping of educational processes and more effective teaching of adults.

Keywords: Five-Factor Model of Personality, personality, personality traits, adult education, learning - teaching.

1 Introduction

According to many scientists, the Big Five is a proposition of a universal model of personality which allows effectively predicting and understanding human individual behaviours. We can also associate it with the learning-teaching process. The aim of the paper is to present the five-factor model of personality, also known as the Big Five, with regard to the functioning of adults in the learning process using digital technologies. In addition, we would like to show certain relationships between the personality dimensions and the set of activities of adults in the learning-teaching process.

In the traditional learning-teaching process, a teacher/lecturer is a person designated by a school as a supervisor of a particular student team and assigned appropriate decision-making and control roles. As a result, a traditional school is a hierarchical, subordinate team concentrating on knowledge transfer and imposing a general course of action, a final goal and, frequently, instructions placed on both students and teachers for performing tasks. Regarding adults, the model of learning organisation within the general education system was still commonly used in the previous century although the differences in the learning process between children, adolescents and adults had been strongly emphasised since the 1950s. Despite these facts, adult teaching is comparable to teaching children and adolescents, while in practice, the above argument is not reflected in many cases (Han, Pistole, 2017). The contemporary, recognised authors support the thesis about a basic difference between the pedagogic and andragogic approaches to the educational process (De Haro, Castejon, Gilar, 2020). For example, they draw attention, in a slightly poetic manner, to pedagogy as the art and the science of teaching children and adolescents, and to andragogy as the art and the science of helping adults in the process of learning (Bastian, McCord, Marks, Carpenter, 2017; Rochovská, Švábová, 2021, 2022). Following this assumption, Lahey remarks that pedagogy concentrates on the "supervisory" education while andragogy focuses on the problems of education and development of "the equals". The learning process in this interpretation is described by Lahey (2009) as follows: "[...] It is

located in human biography and the social and cultural life environment. Their interactions lead to the creation of experience".

In the pedagogic model regarding the education of children, adolescents and frequently young adults, making decisions about what to learn, how to learn, when to learn, why to learn, etc. is the role of teachers, while students must be only obedient recipients of the content and tips provided by educators. The basis of the discussed solution is a currently not always recognised assumption that children and adolescents are not independent individuals, have too little experience in learning and, therefore, should learn everything provided by teachers or other adults. In fact, the main reason is to get promotion to the next stage of education. In the process of learning, students are subject-oriented, and the main sources of their motivation are external influences, primarily rewards and punishments associated with the school marking system. The basic strategies of this learning process are expository methods.

Despite a rapid dissemination of adult learning, the education systems offered only this model and, as a result, adults were treated like children. This approach has become established, and it is still resistant to changes. In researchers' opinion, the reason was not only the conservatism of teachers and individuals responsible for adult education. Typically, teachers are aware of the fact that adults should be taught differently from children and adolescents, but they do not always know how they should do it (Klassen, Kim, 2019). Thus, it seems logical to seek an andragogic model or a theory of education. Such attempts have already been made but they may have been inadequately disseminated (Patterson, Koczwara, Sofat, 2016) The aim of the present paper is to try determining the assumptions of this model which are associated with individual traits and the personalities of learners.

1.1 The process of learning-teaching among adults

The considerations about adult learning should begin with a definition of an adult person (Göncz, 2017) claims that "an adult is a person who has grown up to meet the requirements of the society". This approach to the problem is associated with the necessity of determining the criteria and it makes the category itself an issue of feelings or aspirations but not a subject of objective and transparent cognition. Here, the term of subjective adulthood appears which is defined by an individual and perceived by an individual but not by the society. For further considerations, a little older proposition is worth mentioning. Kaub et al. (2016) describes adulthood in the following way: "An adult is a person who is responsible for himself/herself, has a job, decides about his/her life plans, copes with the difficulties with fulfilling these plans and is responsible for his/her actions before the society. This definition of adulthood includes the following factors: the age, work, psychological and social maturity, and self-reliance". This makes the concept of "adulthood" clearer for further considerations. The dynamics of social change requires continuous improvement, development of competences and, increasingly often, requalification. It makes individuals work on various forms of educational tasks. As a result, adult education which used to have a supplementary role now becomes a popular form of learning activity. Development of the culture, growing requirements and motivations and an increasingly greater availability supported by new technologies leads to its dissemination. Gatzka, Hell (2018) remarks that continuous learning becomes not only a goal but also the basic form of modern education.

The analysis of studies presented in the subject literature and my own experience allows for certain observations regarding adult learners. Both the studies and the related idiographic experiences indicate specific properties of the participation of adults in the learning-teaching process.

One of the most common aspects is the observation that adults want to know and understand why they should learn something. Some research shows that before adults initiate the process of learning, they are ready to devote a lot of time and energy to clarify the potential benefits of learning something and the consequences or costs which are associated with the abandonment of the education (Anušić, Schimmack, 2016). As a consequence, one of the first postulates for organisers of adult education is to stimulate and reinforce the need for learning and to show its usefulness in life. Adults should be treated like individuals and partners in the common pursuit of knowledge.

It should be emphasised that according to the previously assumed definitions of psychological maturity, adults are individuals who have grown up to meet requirements, are responsible for their lives and are ready to take responsibility for their decisions. In other words, adults want to be perceived and treated as individuals who can take responsibility for themselves and their actions. Therefore, adults want subjectivity and independence in the learning-teaching process. This is also important because adults, while being completely self-reliant in various life situations, frequently return to patterns of behaviour and experience from their own school life, become submissive and resign from the subjectivity, activity and the related subjectivity and shared responsibility for the learning process when they initiate this process or the training course. This leads to a conflict as adult learners perceive themselves as dependent on others, but they feel a deep psychological need for independence. Therefore, the ways of supporting adult learners in achieving a greater learning autonomy and independence should be sought (Knowles, Holton & Swanson, 2009).

In addition, adults present a greater and more diversified experience than children and adolescents, which should be considered while designing and dealing with adult education. The variety of experience has an influence on the learning process. Adults bring a specific background or an empirical basis which itself is a valuable source of knowledge (Zapletal, Guzoňová, Rojšl & Lengyelalussy, 2023). Thus, a wider use of methods which refer to the experience, such as a discussion or solving problems by means of earlier acquired knowledge and skills, and methods that provide a lot of new experience, e.g., games and simulation tasks or didactic journeys, is observed. In addition, we frequently mention biographical learning. *Biographical learning is a holistic, integrated, situational and sociocultural form of learning which is adequate to the contemporary challenges. In the context of quickly changing life conditions and destabilisation of traditional social structures, there is a growing role of biographical learning with regard to individuals and the society, i.e., of the skill of using one's own and others' experience, a reflexive attitude to life which allows us to see the learning processes in daily activities and individual or shared initiatives. Beneficial factors for biographical learning are proactivity, involvement in various social roles, creativity, and criticism* (Kaufman, Pumacahua, Holt, 2013).

Most adults have experiences associated not only with school but also with life, including professional work. Compared to adolescents or children, adults look at experience from another perspective and it is an important source of their identity while for adolescents it is something that simply happens. Adults often recognise themselves in the categories of achieved unique experiences. The experience indicates who an individual is. When it is not considered, it cannot become a source of learning. Adults perceive ignoring their experiences as rejecting themselves as individuals. It is particularly observed among poorly educated individuals (Szököl, Dobay, 2022). Properly used and stimulated experience may motivate learning and reinforce its effects. However, experience may carry a negative potential as it is associated with a tendency to acquire thinking habits and prejudices and to formulate *a priori* assumptions which may (or may not) be wrong but are usually relatively stable. In the case of certain personal dispositions, experience is related to rejecting new ideas.

One of the main sources of a readiness to learn is that of transition to subsequent developmental stages. According to Knowles (1996), when we face a requirement to perform tasks typical for the next developmental stage, the readiness to learn these tasks appears. Therefore, adult learners demonstrate a greater readiness to learn when they feel they need to learn something so that they can act more effectively or gain satisfaction. As a result, it is beneficial for them to voluntarily make commitments. Such a perfect situation is rather uncommon. However, employees should not be forced to participate in various, sometimes potentially attractive and expensive training courses without respecting their true attitudes, needs and interests. Thus, it is worth building appropriate approaches and cultural patterns. A sequence of the professional career development may include the following stages:

1. The commencement of the process of career planning.
2. Acquisition of competences necessary to work in the first job.
3. Getting the first job.
4. Complete commitment to the first job.
5. Development of skills necessary to perfectly do the first job.
6. Planning and preparing for the next step in the professional career, which means resuming the above cycle.

Within this context, it is important to adjust (in the time aspect) the educational offer to the stages of professional development. Significant problems regarding adult training appear when individuals are forced to participate in various training courses before they feel ready or when it is too late.

The education of children and adolescents is subject-oriented. In this situation, students perceive learning as the process of acquiring knowledge and skills in particular areas necessary to pass the obligatory tests or examinations. Adults who undertake education are task-oriented (i.e., they concentrate such as writing formal letters, holding discussions, improving interpersonal skills, managing projects etc. A disrespectful on tasks-problems). This difference in orientation requires different ways of developing the educational content (Szököl, 2022). Therefore, the adult education needs the content that is built around less or gradually more complicated tasks or activities, approach to the above principle (sometimes observed) and building or planning the educational programme for adults which resembles that developed for children or adolescents leads to the educational and didactic failure. The key reason for this is the lack of motivation for an active and committed participation in the process which is not recognised as one's own one. Organising the education content around tasks, problems, or situations the participants deal with and indicating the relationship of the educational programmes with daily life help prove its usefulness and build a high motivation for learning (Kaub, Karbach, Spinath, Brünken, 2016). It is worth mentioning the research conducted by Danner (et al., 2019): *"The research conducted at the Pedagogical Academy of Krakow in 2005 among post-graduate students has shown that participants are mostly 24 to 42 years old and their motivation to undertake the course is strictly related to the strategy of professional development. The main motive for undertaking the course is a desire to increase the level and to expand the scope of qualifications, which primarily refers to understanding new information or trends and to shape the adequate skills in the study area"*.

While continuing considerations about the aspects of motivation for learning, it is worth noting that adults are motivated by both external and internal factors. The previous observations show the role of intrinsic motivation in the process of adult learning. Important factors in its development are the perception of action sensibility and the self-development of intrinsic satisfaction with one's own actions or meeting one's needs. However, adult learners are also predisposed to extrinsic motivation components, such as pay rises, better work conditions etc. As Göncz, (2017) remarks, *"Many studies show that adults usually have a greater motivation for learning than children. However, the problem is that this motivation not always refers to learning"*

things other individuals want to teach. Hence, it is very important to implement the first assumption placed in the list mentioned here: stimulation of the need for continuous learning". The key issue is to combine both these sources.

Referring to the previous definitions, we know that adults are individuals who have completed their developmental processes associated with adolescence and maturation. These aspects are particularly important for the course and effectiveness of learning. Their dynamics and course greatly determine the pace and the course of the learning-teaching process. When they are finished, individual traits become important in adult education. Educators have known this fact for a long time. Based on these beliefs, differentiated instruction has emerged. A similar situation is observed in adults. Although differentiated andragogy does not exist yet, it will obviously appear in the future due to a rapid development of this field. Considering the individual traits, it is worth mentioning the Five-Factor Model of Personality or the Big Five developed by P. Costa and R. M. McCrae.

1.2 The Big Five – the Five-Factor Model of Personality by P. Costa and R. M. McCrae

In personality psychology, there are many models of personality such as psychoanalytic, factorial, type, or trait ones. Considerations regarding personality result from the theoretical assumptions of their authors. They are checked within the related paradigms. In certain trends, traits are considered to be the basic units of personality development, which has led to a lot of research on the structure of the personality, its dynamics and hierarchy (Göncz, 2017). Traits should be defined as "stable properties of the personality which internally manage the thoughts and actions of an individual in various circumstances" (Zimbardo, Johnson & McCann, 2008). A trait is the basis for many important personality concepts. Common personality theories which refer to the personality traits were developed in the 1950s. These theories/concepts, developed by G. W. Allport, R. B. Cattell or H. J. Eysenck and based on the factor analysis of personality, were expanded by P. Costa and R. M. McCrae who devised the Five-Factor Model (FFM) of personality, also known as the Big Five (Zimbardo, Johnson & McCann, 2008). It should be emphasised that the Five-Factor Model of Personality is currently one of the most popular concepts which relate a personality to traits. As it seems, "The five-factor model of personality may be a valuable inspiration for academic teachers who run on-line courses. It should be noted that personality is an important controller of the cognitive structures and, as such, of the learning-teaching process" (Loehlin, McCrae, Costa & John, 1998).

The factors included in the Big Five model create five essential dimensions of personality i.e., neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. Each dimension has separate characteristics. Some research instruments based on this theory also include subscales (Woods, Patterson, Koczwara & Sofat, 2016). The characteristics of the dimensions are presented in the table below.

Table 1. Characteristics of the Five-Factor Model of Personality by Costa and McCrae

Factor	Basic characteristics	Characteristics referring to an individual
Neuroticism	A dimension describing emotional adaptation vs. emotional imbalance. Neurotic individuals have a tendency to irrational behaviour, less effectively control their emotions and find it more difficult to cope with stress. Individuals with poor neuroticism are emotionally stable and can cope with stress without internal tension or irritability.	Neuroticism is a tendency to experience various negative emotions such as embarrassment, fear, dissatisfaction, guilt, anger and, at the same time, sensitivity to psychological stress.
Extraversion	A dimension referring	Extraverts are talkative,

	to the quality and quantity of social interactions, the level of activity and energy and the ability to feel positive emotions. Extraversion is associated with gregariousness. In its opposite, i.e., introversion, certain shyness and secretiveness as well as the need to be alone are observed. When a contact with other individuals is made, it is usually very important.	friendly and fun-loving, and they search for stimulation. They are cheerful and highly optimistic about life. On the other hand, introverts are reserved in social settings, which not necessarily means pessimism or unhappiness.
Openness to Experience	It is a dimension referring to a tendency to search for various life experiences and their positive valuating, cognitive curiosity, and tolerance for novelty.	Individuals with great openness to experience are curious about the world and internal phenomena and have more experiences. On the other hand, individuals with poor openness are more conservative and conventional in behaviour and beliefs.
	This dimension refers to the level of persistence regarding organisation and the motivation for tasks aiming at a goal's accomplishment, including the attitudes of a human to work. Conscientiousness is often described as strong will or achievement striving. It is perceived by others as meticulousness and reliability and is most commonly associated with professional achievements. However, very strong conscientiousness is related to workaholism, compulsive perfectionism or an excessive tendency for tidiness.	Conscientious individuals are strong-willed, strive to achieve their goals and are motivated to act. Individuals with poor conscientiousness demonstrate lower levels of the above traits but many studies show they have a tendency for a hedonic life.
Agreeableness ¹	A dimension referring to a positive or negative attitude to others. It may be considered as a personal orientation to altruism or antagonism and experiencing related feelings, thoughts and actions. In the cognitive aspect, this trait manifests itself as: <ul style="list-style-type: none"> • trust in others or lack of it at the emotional level • sensitivity or indifference to others' matters • belief in cooperation or rivalry 	Agreeable individuals are (or try to be) kind to others and ready to help them. They are convinced that others' attitudes are the same or similar. Individuals who are not very agreeable are egocentric and sceptical about human intentions. As a result, they tend to compete with others.

Own data based on: (McCrae, Costa, 2002; Zimbardo, Johnson, McCann, 2008)

Even a cursory analysis demonstrates that the traits listed in the Big Five model, despite their separate terms (neuroticism, extraversion, openness, agreeableness, conscientiousness), are a bipolar spectrum of the intensity of the particular trait. This means that they form a certain continuum and human behaviours may be located and described between each of its two ends. (Zimbardo, Johnson & McCann, 2008). Many researchers think that individual differences may be usefully considered within the above five bipolar dimensions. In the table below, a bipolar description of the traits with the extreme points of the continuum for each of them is presented.

¹ Altruism or antagonism in some papers.

Table 2. Five big personality traits: examples

Characteristics of individuals with high scores	Scale	Subscales used in research instruments	Characteristics of individuals with low scores
Usually worried, nervous, emotional, insecure, sometimes ineffective, showing a hypochondriac tendency	NEUROTICISM (N) The scale measures stability vs. emotional instability	<ul style="list-style-type: none"> • fear • aggressive hostility • impulsiveness • hypersensitivity • shyness 	Calm, usually relaxed, sometimes impassive, resistant, self-confident, self-satisfied
Sociable, active, talkative, people-oriented, usually optimistic, fun-loving, tender	EXTRAVERSION (E) The scale measures a number and intensity of interpersonal relationships, activity level, need for stimulation, joyfulness	<ul style="list-style-type: none"> • sociability • cordiality • activity • sensation seeking • emotionality 	Reserved in social settings, factual, restrained, lacking vital energy, task-oriented, shy, calm
Inquisitive, with many interests, creative, original, imaginative, unconventional	OPENNESS (O) The scale measures seeking activity and new experiences for themselves, the level of tolerance and interest in novelty	<ul style="list-style-type: none"> • imagination • aesthetics • action • ideas • values 	Conventional, realistic, rather narrow-minded, lacking artistic and analytic abilities
Organised, persistent, reliable, disciplined, punctual, meticulous, tidy, ambitious	CONSCIENTIOUSNESS (C) The scale measures the level of organisation, persistence and achievement striving of the person	<ul style="list-style-type: none"> • competences • tidiness • achievement striving • self-discipline • sensibility 	Lacking precise life goals, unreliable, careless, too relaxed, neglectful, weak-willed, hedonistic
Understanding, kind-hearted, helpful, forgiving, naïve, straightforward	AGREEABLENESS (A) The scale measures the quality of interpersonal relationships in the continuum and sympathy or hostility regarding thoughts, feelings and actions.	<ul style="list-style-type: none"> • trust • straightforwardness • compliance • modesty • tendency for self-pity 	Cynical, indelicate, suspicious, uncooperative, vindictive, unscrupulous, irritable, manipulative

Based on Woods, Patterson, Koczwara, Sofat, 2016.

There are many studies which show relationships between effective actions and the personality traits included in the Big Five. In our pilot study, we searched for ways to observe the relationships between these traits and functioning in the learning-teaching process and adult education.

2 Methods and course of the pilot study

A group of students with high levels of one or several measured traits were interviewed to understand the influence of the personality traits described in the Big Five. Overall, 60 students of pedagogy, 5 students of Information Technology, 9 students of economics and 6 students of nursing were the study subjects. The study group consisted of 7 men, 72 women and one person with undeclared gender.

In the study, the most popular short method of the "Big Five" traits (neuroticism, extraversion, conscientiousness, openness to experience and agreeableness) measurements, i.e., the Ten-Item Personality Inventory" (TIPI) devised by Gosling, Rentfrow and Swann (2003), were used. The conducted studies (Woods, Patterson, Koczwara, Sofat, 2016) show that this two-minute test is a relatively accurate and reliable instrument for personality measurements in scientific research. The studies confirm high levels of accuracy and reliability of the Polish version of the TIPI inventory. Moreover, the equivalence of the Polish version in the forms of a classical paper and pencil interview and an on-line version was verified. The research showed that the Polish adaptation might be used in both conventional and on-line interviews. The findings of the paper and on-line interviews were comparable. In addition, similarly to the TIPI original version (Gosling et al., 2003) and independently from the applied TIPI-PL version, a significant negative relationship between all pairs of items referring to the particular personality traits was observed. The research was conducted in the first half of 2018. Based on the test results, 15 subjects out of 80 students with very high TIPI-PL scores were selected. Among the subjects, three individuals were identified with the highest TIPI-PL scores for each trait, i.e., Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to Experience. This group consisted of 12 women and 3 men.

Each subject was interviewed (conversation). This was an idiographic study, but the interview was narrative, which allowed for relatively free statements about the subjects' learning activities. The interview, which was a kind of social interaction between the researcher and the study subject who answered specific questions associated with the research issue, also aimed at seeking other possible relationships. Subjective biographic constructs were sought. This research method assumes that a subject has the knowledge and subjective constructs which refer to the research issue and the importance of personal experience. Understanding these constructs and experiences becomes the primary research task. However, it should be noted that according to the hermeneutic tradition, a researcher also has his/her own constructs and based on them, interprets subjectively subjects' answers during the interview focusing on social constructs. Moreover, the interview interaction demonstrates specific dynamics based on continuous interpreting and establishing of meanings between a researcher (asking) and a subject (answering).

The following open questions were asked:

- Do you readily undertake educational activities? How often? Why?
- Do you use modern technologies in learning? Which ones?
- What forms and methods of education are particularly important to you?
- Which forms and methods of teaching don't you like?
- Do you have or have you ever had learning difficulties?
- The questions were followed by a free discussion about adult education and learning.

The interviews were held in a free and nice atmosphere at the university canteen (when it was possible) or in an unoccupied classroom. All efforts were made to ensure that the place and the situation were comfortable for the respondents.

2.1 The Big Five traits as the prediction of adult learner/student behaviour

In light of the pilot study, the factors which form the personality and are listed in the Big Five model, i.e., neuroticism, extraversion, openness, agreeableness and conscientiousness, show a certain relationship with some aspects of the students' behaviours during the learning-teaching process. This would indicate an important relationship between the above-mentioned personality dimensions and the professional effectiveness where each of the five traits has been useful for understanding individual behaviour in organisations (Hurtado Rúa, Stead & Poklar, 2019).

The analysis of the interviews and free conversations of the subjects in the learning environment (most of the student subjects were supervised by the study researcher) allows for formulating tips regarding predictions of adult learner behaviours, both those with high- and low-graded results. However, these findings require verification on a larger research sample, both in the nomographic research and the research with extended idiographic methods. The analysis conclusions are presented in Table 3.

Table 3. Results of the qualitative analysis of the interviews

Conclusions for high scores	Conclusions for low scores (theoretical assumptions)
Extraversion	
Compared to introverts, extraverts generally better feel in life and group learning, which is probably associated with the fact they feel more positive emotions and are able to show them more freely. They absolutely prefer the forms of learning which require human interactions. Moreover, extraverts better deal with rapid information flow. In two cases, the respondents declared that they had had problems during their school education, which might have been related to the low conscientiousness score.	Introverts, i.e., individuals with a low extraversion score, do not feel comfortable during university classes. They absolutely prefer home studying or learning in a library (if necessary) and individual tasks. It is highly probable that introverts are better at reflexive solving of problems.

Neuroticism	
Individuals who have high neuroticism scores are not educationally confident, probably due to a low level of optimism and frequently perceived negative emotions. They are also not resistant to stress associated with practically all kinds of testing of knowledge, and when stressed, they are not able to focus on the issue at hand. It seems that neuroticism is the most significant reason for adult educational failure among all the Big Five traits. Neurotics (none in the research) rarely undertake learning activities when they are not forced to do so by external factors.	Individuals with low neuroticism scores are happier and they frequently find a lot of satisfaction from learning, probably due to a higher level of optimism and less negative emotions. They are also more resistant to stress and focus on the problem at hand in stressful situations. It seems that a low neuroticism score is associated with the best coping with testing of knowledge.
Openness to Experience	
According to the literature and many studies, individuals with high openness to experience demonstrated greater creativity. Moreover, such individuals feel better in conditions of ambiguity and changes in education – these did not discourage them and were even motivating. Therefore, open individuals more effectively and readily undertake unusual educational activities and use modern solutions such as e-learning. They also more willingly undertake education, more easily solve tasks, and achieve high results.	Individuals with poor openness to experience certainly prefer traditional (for them) teaching methods. They reluctantly accept new solutions and find it difficult to approve them.
Conscientiousness	
As a personality trait, conscientiousness is closely related to diligence and dutifulness. In education, these are individuals who always try to be prepared for classes and hand in their homework on time. As a result, they also achieve very good learning-teaching results. Conscientiousness, which is a controller of behaviour regarding long-term goals (DeYoung, 2010), has an impact on maintaining motivation for learning and not abandoning it even in the situation of external factor changes (confirmed in one case). Individuals with a high level of conscientiousness do not like changes of lecturers and teaching methods even when it seems beneficial.	Individuals with poor conscientiousness are certainly less sensitive to changes in the learning-teaching process, more willingly undertake new tasks and better respond to changes such as the way of examining.
Agreeableness	
No relationships between agreeableness and the learning-teaching process were found in the study. However, it may be observed that friendly individuals are more popular, often submissive, and obedient. They should achieve better results in tasks where interpersonal relationships are important, which was confirmed by self-reflection.	No relationships between poor agreeableness and the education processes were found in the study. However, it is observed that they more often provoke disputes both with colleagues and lecturers or the university administration in various educational situations. Moreover, they are brave and not afraid of adversities.

Based on own study results, interviews, and observation

Regardless of the observations, it should be noted that when the levels of the traits based on the five-factor theory are determined, a result not necessarily is good or bad. Each trait may have an adaptive character depending on the social situation, professional position or cultural perspective. Thus, a certain trait may be more welcome in a particular educational environment, but it will not be beneficial for the learning-teaching process in another one. For example, poor extraversion will be more wanted for writing an individual final paper, while high extraversion will be perfect for group research projects. A creative person will benefit from poor agreeableness, while excessive openness may prevent an individual achieving mastery in one field (Kim, Jörg & Klassen, 2019).

3 Summary and conclusions

The usefulness of the Big Five should not evoke a uniformity illusion. Each theory is somehow limited. Fauth (et al., 2019) indicates that *“in addition to the central components, there are peripheral ones which are external to the personality although they are closely related to it. These peripheral components are biological bases and external influences (i.e. inputs) and objective biography (the course of life, actions taken across the lifespan, collected records of everything an individual does and*

experiences)”. Nevertheless, the initial research is very promising. Summing up, It should be noted that personality is an important controller of the cognitive structures and, as such, of the learning-teaching process. In the work of an andragogist and educator, a properly selected and applied instrument, and a rational use of the Big Five theory may be very helpful in solving difficult situations or overcoming problems. It is an excellent instrument which supplements the repertoire of an andrologist-educator regarding planning and conducting the learning-teaching process. The development of various forms of adult education and the need for continuous improvement of these forms requires further, in-depth research.

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JEWISH, CHRISTIAN, AND MUSLIM DIALOGUE (PHILOSOPHICAL REFLECTIONS)

^aRUDOLF DUPKALA, ^bBEÁTA BALOGOVÁ

University of Prešov, Faculty of Arts, 080 01 Prešov, Slovakia
email: ^arudolf.dupkala@unipo.sk, ^bbeata.balogova@unipo.sk

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Abstract: The leitmotif of the submission (article) is the issue of Jewish, Christian, and Muslim dialogue. The methodological foundation for the study of this issue is the concept of axiological pluralism, which includes not only value pluralism, but also cultural and religious pluralism, and ultimately a plurality of interpretations of these historical and social phenomena as well. The basic foundations for this dialogue, as stated in the submission, are the common features of Judaism, Christianity, and Islam inferred from their monotheism. Among obstacles of this dialogue can be listed: intolerance, fanaticism, and extremist interpretation of holy texts. The goal of the dialogue should be substantiation of shared responsibility of the three aforementioned 'Abrahamic religions' for maintaining and cultivating conditions for life on our planet.

Keywords: axiology; dialogue; Christianity; Islam; Judaism; pluralism; religion.

"We must not (...) think that our religion alone represents the whole Truth, and all the others are false. A reverent study of the other religions of the world would show that they are equally true as our own"
(Mahatma Gandhi)

1 Conditions for Dialogue

The world of people, which comprises a dynamic system of diverse cultures, necessitates dialogue. However, as R. Girard aptly states: "in the present day, the more we speak of dialogue, the less often it occurs" (Girard 2011, p. 193).

It is clear that most problems in communication arise when the bases and approaches to searching for the answer to the question of common interest are distinctly different, or even contradictory. According to R. Rorty (1991, p. 170-171), one of the essential prerequisites of a dialogue is that its participants must at least minimally agree on the premises, i.e., starting theses and statements, with which they enter into dialogue. This is further proven by the following statement: "one can make any number of foolish, nonsensical or mad claims that are irrefutable. This is the consequence of the fact that terms such as argument, dispute, quarrel only make sense in situations where the participants of the dialogue are able to reach at least minimal agreement. We can only disprove the opinion of a person who acknowledges at least some of our premises. People who agree with too few generally accepted premises are not considered undefeatable opponents, but rather too childish to debate with at all. All discourse – moral, scientific, literary – has certain entry requirements, so to speak, and before one can be taken seriously within it, one must present one's credentials".

Based on the above we have formulated the following research hypothesis: If interreligious dialogue does not contain mutual respect for commensurability and incommensurability of the value orientation of the dialogue's participants, then the dialogue cannot be meaningful and it is doomed to fail.

Among basic requirements for a meaningful interreligious dialogue can be counted: respecting the principle of *full equality* of all participants, the principle of *freedom of thought, religion and expression*, the right to argue the reasoning and verification of one's own opinions including the option of *self-correction*, the right to cultural identity and value orientation inherent to it, etc. L. Pasternáková (2018) states: "In today's flood of stimuli and plurality of influences arising from dangers to society and associated risks, it is urgently necessary to learn to evaluate and to create and protect real values." In other words, for a dialogue to fulfil its purpose, it must be *democratic, informal, open, fair...* and especially, it must be realized within the boundaries of mutually accepted tolerance. Particularly relevant is the rule of *receiving respect in return for giving respect*.

This also fully applies to Jewish, Christian, and Muslim dialogue, which can, additionally, only fulfil its purpose when its participants acknowledge religious pluralism without surrendering their own cultural identity and the value orientation inherent to it. This is because interfaith dialogue is not (primarily) concerned with a particular participant being or not being *right*; it is instead concerned with reaching a state of mutual respect for one another's *right to be right* and the validity of that state within the boundaries of the system of values that the participant of the dialogue is anthropologically and generally anchored to.

Ultimately, individuals with contrasting value orientation are not able to agree on what is or what is not the *truth*. That is most likely the reason why even Pilate responded to Jesus' claim that he – meaning Jesus – was "born and (...) [has] come into the world—to bear witness to the truth" with the question "What is truth?" (Jn. 8:37-38, ESV). Of course, this statement does not refer to empirically verifiable truths of the natural sciences, the *universal* validity of which is not being questioned here.

At the same time, we should remember the wise *warning* of L. Wittgenstein (2001, p. 69), who states that it is not possible to communicate using false propositions.

In this context, we believe that the primary goal and purpose of interfaith dialogue does not lie in answeringgnoseological or metaphysical questions, but rather in the mutual search for conditions for humane and dignified coexistence of people with different value (cultural, moral, legal, and political) orientation.

It should also be kept in mind that the current interfaith dialogue is being realized within the atmosphere of value and religious pluralism. In other words: the purpose of interfaith dialogue is not (and cannot be) 'overcoming' or even 'cancelling' plurality of ideas which is, in a world of diverse cultures, civilizations, and value orientations – necessary. On the contrary! The purpose of dialogue is to convince its participants that this plurality is necessary and it must be tolerated, because all that is diverse or *different* can only coexist on the condition of mutual tolerance. In this respect, interfaith dialogue can be characterized as the most humanly natural and appropriate method of communication. Respecting and asserting the position of axiological pluralism also supports meaningful communication of not just religions, but also entire cultures and civilizations.

Considering the above, we would like to emphasize one more time that Jewish, Christian, and Muslim dialogue can only fulfil its purpose if it respects at least these (fundamental) conditions and criteria:

- the most equal status of all its participants,
- the guarantee of and respect for *freedom of thought*,
- the ability and willingness to listen to *the other party*,
- consensus regarding the content or thematic focus of the conversation,
- mutual helpfulness when dealing with acute existential problems,
- cultured manners and fairness in the manner and style of communication,
- mutual tolerance,
- mutual establishment of 'dialogue boundaries', i.e., an agreement stating what is 'not to be discussed', etc.

The 'boundaries' of interreligious dialogue must be set in relation to the 'boundaries' of freedom of speech. The freedom of one participant ends where another's begins. The right to 'abstain from speaking' should be part of freedom of speech in interfaith dialogue, especially if speaking one's mind would lead to increased tension, etc. Such situations demand adherence to the following *rule* of L. Wittgenstein (2001, p. 3): "what we cannot talk about we must pass over in silence".

On the other hand, among some of the most significant barriers to meaningful interfaith dialogue we can count, according to V. F. Birkenbihl (1999, p. 66): “the tendency of some participants of the dialogue to boss other participants *around*, indifference to the opinions of *the other participants*, inability to empathize, communication egoism, etc.”

Following the aforementioned conditions for interfaith dialogue, it can be observed that its main goal should be *consensus* on: solutions to contemporary issues of humanity, ways to preserve a sustainable level of life on Earth, as well as overall racial, ethnic, cultural and religious diversity of humanity, respect for human dignity and the creation of conditions for tolerant coexistence of people with diverse value orientations... etc.

This prompts the question: when can representatives of different religions achieve consensus while solving the aforementioned problems, and when can they not? We suppose that, when solving these problems, consensus can be reached, provided that they apply identical or at least comparable (similar and related) criteria of evaluation based on an identical or comparable understanding of values. Consensus cannot be reached if, when solving the aforementioned problems, they apply distinctly different (incomparable, even clashing) criteria of evaluation based on a different understanding of values.

Once more it should be stated that a necessary condition for interfaith dialogue is mutual tolerance of participating religions, which is suggested through acknowledgement of religious pluralism.

The importance of tolerance within the context of religious pluralism was already emphasized in the middle of the 20th century by Mahatma Gandhi (1962, p. 1), who said: “We must not (...) think that our religion alone represents the whole *Truth*, and all the others are false. A reverent study of the other religions of the world would show that they are equally true as our own”. These words – spoken by one of the most significant apologists for interfaith dialogue – imply that God belongs to ‘all’ religions (not just one) and that there are multiple paths leading to religious *salvation* (‘salvation pluralism’), etc.

Kahlil Gibran (1932, p. 18) called attention to this in his work named *The Lightning Flash*, which describes the story of a bishop who perished due to a lightning strike after saying that salvation is only possible for those who are “baptized of water and of the spirit”.

Based on the subject of this work, at least the basic foundations, options, and limits of Jewish, Christian, and Muslim dialogue will be discussed.

But first, it should be emphasized that a dialogue is not a *competition* and that its outcome cannot be a *victory* of one party only. A dialogue is a tool for building relationships and this is especially true for interreligious dialogue, which is much more specific. It could be said that the success of this dialogue depends on mutual tolerance and mutual respect – to a much greater degree – than in other forms of dialogue. In this kind of dialogue it is also absolutely necessary to *refrain* from using any means of expression (words, gestures, actions, etc.) that could be perceived as an *insult* or *degradation* of the religious faith of the other party.

However, this does not mean that interfaith dialogue can be realized in a so-called ‘vacuum of values’. It is rather the opposite! Participants of this dialogue typically have a very clearly defined value stance (and orientation) and so some of the necessary requirements for a meaningful conversation must be mutual tolerance and respect. (This also refers to a quote by pope Francis (2015b): “Mutual respect is the condition and, at the same time, the aim of interreligious dialogue”. This also fully applies to Jewish, Christian, and Muslim dialogue, which is also interesting from the perspective of integration of immigrants in Europe (particularly the Muslims). ‘Future Europe’ would likely do well to start preparing for this dialogue today.

It is clear that said dialogue is objectively limited through *catechistic* (theological, or perhaps dogmatic) foundations of these religions, which are simply not open to discussion. This also concerns the understanding of God himself, his *transcendence* and *eminence*, his *uniqueness* and *hypostases*, etc. Martin Buber (2016, p. 65) expressed it through these words: “God is an existence that can be addressed, yet is unspeakable”. We should not forget the fact that God was God even before the religions of the Jews, Christians and Muslims appeared.

2 Jewish-Christian Dialogue

As far as the Jewish-Christian dialogue is concerned, it should be said that important foundations and limits of this dialogue can be tracked in history to the process of formation of Christianity, i.e., the life of Jesus Christ. Just as the attitude of the Jews towards Jesus was ambivalent, so was the attitude of Jesus towards the Jews. Some gnostic and heretical, in relation to early Christianity, movements had a negative attitude towards Judaism and the Old Testament. “Marcion was not a Gnostic, and the ecclesiastical authorities called him a heretic. He drew the consequences from the disputes between Paul and Peter, and in an effort to avoid Judaism he established the first great heresy. He claimed that the apostles outside Paul had inserted Jewish ideas into Paul’s letters, which he sought to eliminate” (Ambrozy 2021, p. 10).

One group of Jews accepted Jesus as the Messiah, whose arrival had already been foretold by the *Old Testament*, and they faithfully followed him. Another group of Jews, who associated themselves with the Pharisees, rejected Jesus as the Messiah and had serious reservations about his influence. This was also demonstrated in several ‘dialogues’ of Jesus and the Pharisees, one of which, according to the Book of John, went as follows:

“So the Pharisees said to him, ‘You are bearing witness about yourself; your testimony is not true.’ Jesus answered, ‘Even if I do bear witness about myself, my testimony is true, for I know where I came from and where I am going, but you do not know where I come from or where I am going. (...) I am the one who bears witness about myself, and the Father who sent me bears witness about me.’ They said to him therefore, ‘Where is your Father?’ Jesus answered, ‘You know neither me nor my Father. If you knew me, you would know my Father also.’ (...)”

They answered him, ‘We are offspring of Abraham (...)’

‘I know that you are offspring of Abraham; yet you seek to kill me because my word finds no place in you. I speak of what I have seen with my Father, and you do what you have heard from your father.’ (...)

They said to him, ‘We were not born of sexual immorality. We have one Father—even God.’ Jesus said to them, ‘If God were your Father, you would love me, for I came from God and I am here. I came not of my own accord, but he sent me. Why do you not understand what I say? It is because you cannot bear to hear my word. You are of your father the devil, and your will is to do your father’s desires. He was a murderer from the beginning, and does not stand in the truth, because there is no truth in him. (...) But because I tell the truth, you do not believe me. (...)’

‘Are you greater than our father Abraham, who died? And the prophets died! Who do you make yourself out to be?’ Jesus answered, ‘If I glorify myself, my glory is nothing. It is my Father who glorifies me (...) Your father Abraham rejoiced that he would see my day. He saw it and was glad.’ So the Jews said to him, ‘You are not yet fifty years old, and have you seen Abraham?’ Jesus said to them, ‘Truly, truly, I say to you, before Abraham was, I am.’ So they picked up stones to throw at him, but Jesus hid himself and went out of the temple” (Jn 8:13-59, ESV).

For the sake of completeness, it should be added that Jesus – according to the cited gospel – also speaks to the Jews who came to believe in him, and this is what he says:

“If you abide in my word, you are truly my disciples, and you will know the truth, and the truth will set you free.’ (...) ‘51 Truly, truly, I say to you, if anyone keeps my word, he will never see death’” (Jn 8:31-51, ESV).

I suppose that this conversation between Jesus and the Jews already hinted at the basic foundations and limitations of the later Jewish-Christian dialogue.

Both of these religions ‘spring’ from the same *spiritual source*. They have the same *forefather* in Abraham, they also share a prophetic tradition, etc. In spite of this, their interpretations of the most important question of catechism, i.e., the question of God, differ.

However, this does not mean that Jewish-Christian dialogue loses its meaning. Present-day Christianity and Judaism are characterized by a considerable degree of tolerance for diverse interpretations, which is an irreplaceable requirement for their ‘contemplating together’ not only the global danger to life on Earth, but also specific issues relating to the peaceful coexistence of people of diverse religions.

This requirement for meaningful conversation between present-day Judaism and the world of other religions is also discussed by the famous teacher of *Jewish thought*, R. Cohen (2002, p. 104), when he states: “the Talmud speaks of many scholars who live according to their own *Halakha*, not caring that their actions are different from what the general rules dictate. A man acting according to his own idea of truth will not be spurned. Abiding by the rules that apply to all must not lead to suppression of one’s perspective, which is based on a different understanding than the understanding of a larger number of people”.

The above statement represents not just a more acceptable position for a meaningful dialogue, but also one of the requirements for overcoming fanaticism, which is unacceptable in and incongruous with any and all dialogue. This issue is also discussed by P. Dancák (2016) in his thought-provoking study named *Regarding symptoms of religiously motivated xenophobia within the bounds of tolerance and unclear pluralism*.

R. Cohen (2002, p. 83) answers the question “what method does the *Talmud* use to argue?” with: “The *Talmud* contains long chains of arguments which contradict each other. As soon as a thought is declared and often supported using verses, different, contradicting thoughts are declared in turn and the previously stated evidence shatters. Therefore, no truth is gained (...) *Talmud* encourages us to debate and especially to continue doing so (...) This dialogue acknowledges all perspectives. An argument does not lose value if it is disproven. On the contrary, although it will be brushed aside for the following centuries, perhaps it reflects the future to a much greater degree than the accepted conclusions that the world considered reasonable at the time”.

R. Cohen (2002, p. 114) also states that the basic *catechistic* and ethical conditions for a dialogue with Judaism are as follows: monotheism, prohibitions of blasphemy, theft, murder, incest, adultery, eating a part of an animal that yet lives, and acknowledgement of the local court of law, etc.

Present-day Jewish thought – in interreligious dialogue – also proposes the idea of a so-called “non-universal identity”. This idea was also publicized by the famous rabbi Jonathan Sacks, who, within the given context, states that Judaism is based on a “dual covenant”, which includes the *covenant* of God with all of humanity, but also his *covenant* with a specific people on Mount Sinai. “Judaism,” writes J. Sacks (2003, p. viii), “attempts to balance concern with the universal (the duties and rights we share as human beings) and respect for the particular (...) giving us our singular, non-universal identity”.

In relation to his understanding of the *Old Testament*, Sacks (2003, p. 51) even states that it already suggests the direction

“from the universal to the particular”, that “universalism is the first, not the last, phase in the growth of the moral imagination”

J. Sacks (2003, p. 51) believes that God first entered into a *covenant* with all of humanity, and only consequently did he do the same with individual peoples. In relation to this, Sacks wrote: “The world of the first eleven chapters of Genesis is global, a monoculture (‘the whole world had one language and a common speech’). It is important to add that the very same Yahweh transformed the original (“global”) unity into diversity when he “descended” when the tower of Babel was being built and caused the “confusion” of the language of the people. He was also the reason why the people – who initially inhabited one city – dispersed all over the world (Gn 11:5-9, ESV).

I believe that J. Sacks, through his understanding of the Bible and Judaism, is creating a real space for dialogue with other religions, because he ‘dismantles’ what was and still is a nearly insurmountable obstacle: a fundamentalistic *monopoly* (of respective religions) *on salvation*. J. Sacks (2003, pp. 52-53) describes this as follows: “[Judaism] believes in one God but not in one exclusive path to salvation. *The God of the Israelites is the God of all mankind, but the demands made of the Israelites are not asked of all mankind*. There is no equivalent in Judaism to the doctrine that *extra ecclesiam non est salus*, ‘outside the Church there is no salvation’. On the contrary, Judaism’s ancient sages maintained that ‘the pious of the nations have a share in the world to come’”.

This stance regarding salvation being possible through the worship of any monotheistic religion represents a truly feasible platform for their mutual dialogue as well.

The rabbi Sacks (2003, p. 55) declares this unambiguously: “As Jews we believe that God has made a covenant with a singular people, but that does not exclude the possibility of other peoples, cultures and faiths finding their own relationship with God within the shared frame of the Noahide laws. (...) God is God of all humanity, but between Babel and the end of days no single faith is the faith of all humanity”.

This stance is – in our opinion – in accord with the position of axiological pluralism, which implies not only respect for value pluralism in general, but also respect for religious pluralism and multiple *paths to salvation*. However, this presupposes the ability and willingness to *hear* ‘the voice of God’ in a language different from one’s own and to *see* manifestations of ‘His will’ in ideas, customs, traditions, rituals, symbols different from those making up the heart of our own spiritual culture or religion.

It is this willingness and ability that makes interfaith dialogue a tool for mutual understanding as well as a *cure* to stop outbreaks of violence stemming from fanaticism. This belief is also expressed by Sacks (2003, p. 56): “Just as a loving parent is pained by sibling rivalry, so God asks us, his children, not to fight or seek to dominate one another. God, author of diversity, is the unifying presence within diversity”.

We fully agree with this viewpoint and we express hope that it will be applied not only within the present-day Jewish-Christian dialogue, but also Muslim-Christian dialogue, the results of which can significantly influence the process of integration of Muslim immigrants in the ‘future Europe’.

3 Muslim-Christian Dialogue

Similarly to Jewish-Christian dialogue, what connects or catechistically ‘bridges’ these religions should also become the base that Muslim-Christian dialogue is to be built on.

It would appear that a common trait of these religions is the spiritual connection to the *Old Testament*. From it can be inferred – at least generally speaking – both Christian and Islamic *monotheism* (the belief in ‘one God’ – *Tawhid* in Islam), *prophetism* (teachings of the prophets – *Anbiya* in Islam),

angelology (teachings about angels – *Malaikah* in Islam), *eschatology* (teachings about judgement day – *Yaum al-Qiyamah* in Islam), *predestination* (teachings about predestination – *Al-Qada Wa Al-Qadar* in Islam), *messianism* (teachings about the coming of the Messiah – *Mahdi* in Islam, also known as teachings about the so-called ‘Hidden *Imam*’), etc.

Among the concepts catechistically ‘bridging’ Christianity and Islam, as well as one of the conditions for their dialogue, is the fact that Islam includes both the Jews and Christians among the people who received ‘God’s word’, calling them ‘People of the Book’ or ‘Possessors of the Scripture’ (*Ahl al-Kitab* in Arabic). This fact should not be overestimated, however, because similarly to Jews, Christians have also already been described as ‘idolaters’ against whom – assuming they do not submit to Islam in accord with the radical interpretation of the *Sharia* – violence may be used. The standing of Christians in Afghanistan, Somalia, Sudan, etc. can serve as an examples of this.

It seems that the Muslim-Christian dialogue will likely depend mainly on its actual participants and their ability to respect the fact that both of these religions are equally valuable and true to their faithful.

Although to Muslims Islam means ‘submitting to the will of Allah’, the faith of individual Muslims does not represent an ‘equally deep’ layer of their psyche or their personal spiritual identity, etc. L. Kropáček (2002, p. 78) states: “Differences appear and manifest in the real selection of offered values. The common foundation of all Muslims is made up of the *Quran* and the five pillars of Islam (profession of faith, prayer, alms, fasting, and pilgrimage to Mecca), but beyond it lies a vast selection of diverse and even contradictory orientations (...) Muslim writers engaging in polemic do not openly speak of multiple *Islams*, but they do concede that there are deep internal disputes relating to the understanding of the Quranic faith (...) There are no doubts in regards to the authenticity of the Quranic text, but there are many issues with interpreting it, especially in matters of the law”.

It is clear that so-called ‘moderate’ interpretations of the *Quran* have a greater chance of success in Muslim-Christian dialogue, and this is also true in relation to interpretations of the *Bible*. To put it simply: without mutual respect, every dialogue is – sooner or later – doomed to fail.

Arguments in favour of Muslim-Christian dialogue can also be found in the *Quran* itself, specifically in the verses referring to a common source of all three above mentioned religions. For example, as stated in *The Clear Quran* (translated by Dr. Mustafa Khattab, 2015): “O humanity! Indeed, We created you from a male and a female, and made you into peoples and tribes so that you may get to know one another” (The *Quran*, 49:13).

The result of knowing one another should be – according to the *Quran* – the conviction that: “We believe in Allah and what has been revealed to us; and what was revealed to Abraham, Ishmael, Isaac, Jacob, and his descendants; and what was given to Moses, Jesus, and other prophets from their Lord. We make no distinction between any of them. And to Allah we all submit.” (The *Quran*, 2:136).

The strongest argument in favour of Jewish, Christian, and Muslim dialogue could be – according to the *Quran* – the fact that all these religions have one (*common*) God. The verse 139 from the second chapter of the *Quran* demonstrates this: “Would you dispute with us about Allah, while He is our Lord and your Lord?” (The *Quran*, 2:139).

A significant requirement for dialogue between Muslims and other citizens can be found in the third chapter of the *Quran* (verse 159), where Allah literally commands the Prophet to *consult with others* before making his decision and this command is even accompanied by a call to forgive. The *Quran* reads: “It is out of Allah’s mercy that you O Prophet have been lenient with them. (...) So pardon them, ask Allah’s forgiveness

for them, and consult with them in conducting matters. Once you make a decision, put your trust in Allah. Surely Allah loves those who trust in Him” (The *Quran*, 3:159).

In Arabic, a consultation or acquainting oneself with a different opinion is called “*Ash-Shura*”. The purpose of this consultation is: “1. to find the correct solution to the problem, 2. to have the people participate in this solution 3. to have the people participate in exercising power. This is one of the methods of Islamic democracy. Consulting others and obtaining a better perspective means that despotism of the ruler and his government cannot manifest. However, rulers often ignore this” (Bahboub et al. 2008, p. 285).

The *Quran*, however, also includes arguments against peaceful coexistence of devotees of these three religions, and therefore also against their *dialogue*. This can be seen in the following verse: “Even if you were to bring every proof to the People of the Book [Jews and Christians], they would not accept your direction of prayer, nor would you accept theirs; nor would any of them accept the direction of prayer of another. And if you were to follow their desires after all the knowledge that has come to you, then you would certainly be one of the wrongdoers” (The *Quran*, 2:145).

Among obstacles preventing interreligious dialogue of Islam and other religions could be counted the following verses of the *Quran*: “He [God] is the One Who has sent His Messenger [Muhammad] with right guidance and the religion of truth, making it prevail over all others. And sufficient is Allah as a Witness” (The *Quran*, 48:28). Or: “He [God] is the One Who sent down serenity upon the hearts of the believers (...) So He may admit believing men and women into Gardens under which rivers flow [Paradise] (...) Also so that He may punish hypocrite men and women and polytheistic men and women, who harbour evil thoughts of Allah. May ill-fate befall them! Allah is displeased with them. He has condemned them and prepared for them Hell” (The *Quran*, 48:4-6).

Further obstructions to dialogue of Islam and other religions are included in these verses of the *Quran*, cited in both Arabic and English for accuracy:

لَعَلَّم بَعْضًا إِنْ الدِّينَ عِنْدَ اللَّهِ الْإِسْلَامُ وَمَا اخْتَلَفَ الَّذِينَ أُوتُوا الْكِتَابَ إِلَّا مِنْ بَعْدِ مَا جَاءَهُمْ أَلَمْ يَكُنْ اللَّهُ سَرِيعَ الْحِسَابِ بَيْنَهُمْ وَمَنْ يَكْفُرْ بِنَيْتِ اللَّهِ

“Certainly, Allah’s only Way is Islam. Those who were given the Scripture did not dispute among themselves’ out of mutual envy until knowledge came to them. Whoever denies Allah’s signs, then surely Allah is swift in reckoning.” (The *Quran*, 3:19).”

وَمَنْ يَبْتَغِ غَيْرَ الْإِسْلَامِ دِينًا فَلَنْ يُقْبَلَ مِنْهُ وَهُوَ فِي آلاءِ آخِرَةِ مِنَ الْخَاسِرِينَ

“Whoever seeks a way other than Islam, it will never be accepted from them, and in the Hereafter they will be among the losers.” (The *Quran*, 3:85).

The reasoning that Islam is *universally valid* for all can be considered another obvious obstacle in interreligious dialogue. This reasoning can be found in the chapter 3 verse 3 of the *Quran*. Abdulwahab Al-Sbernaty (2008) presents this verse in his translation of the *Quran* into Slovak (with annotations) as follows: “Today I finished your (*people*) religion (*the base of your religion*), I concluded my gift to you and I allowed Islam to be your religion (*I allowed Islam to become a religion for all in its final form*)”

For the sake of completeness we must add that Abdulwahab Al-Sbernaty (2016, p. 14), who translated the *Quran* into Slovak, remarks – in our opinion, correctly – in one of his works about Islam, that: “the messages and texts of Heaven are only a kind of lead, an instruction manual that describes how to believe in God and worship Him without doing wrong”.

Indeed, this is how the *holy texts* of all three religions discussed in this text should be perceived: Judaism, Christianity, and Islam. God should be worshipped in such a way that his believers do no wrong to other people, whether they *be faithful* or *not*. Within the context of one group of believers doing harm to another group of believers, the following quote should be kept in mind: *there will be no peace nor understanding between people so long as there is no peace nor understanding between religions*.

The previously cited verses of the *Quran* imply that explicitly religious questions or topics are likely to generate conflict; it would be better to replace them with issues of *common interest*, e.g.: the ecological threat of the global crisis, conditions for maintaining life on earth (through accessibility of food and water for everyone), etc. A suitable topic for the dialogue of three 'Abrahamic religions' could be the encyclic of Pope Francis (2015a), *Laudato si'*, the leitmotif of which comprises environmental issues. The Roman Pope here – besides other topics – also “invites” all people of *good will* to engage in “dialogue on the environment”, he requests “educating for the covenant between humanity and the environment”, initiates “ecological education and spirituality”, presents “a Christian prayer in union with creation” for our earth... etc. Initiatives such as this often spark dialogue in general, but also specifically Jewish, Christian, and Muslim dialogue.

On the other hand – as was previously stated – the greatest obstacle to meaningful interreligious dialogue is *intolerance*, which in this case manifests through one of the participants usurping the right to declare another religion ‘idolatry’ while refusing a similar label for their own religion. There are records of past cases where respective religions considered any critical remark whatsoever an insult and in order to defend themselves, they were willing to resort to violence.

Intolerance, as an *obstacle* to Jewish-Muslim dialogue, is already mentioned in the so-called ‘*Sirah*’, i.e., the work of Ibn Ishaq named *The Biography of the Prophet of Allah (Sirah Rasul Allah in Arabic)*. As a reminder, this work, along with the *Quran* and collections of so-called ‘*Hadith*’ together make up the “holy trilogy” of Islam.

Ján Pauliny (1967, p. 13), who translated the above mentioned work into Slovak, emphasizes its historical and catechistic significance: “This text is canonical to Muslims. In their eyes, it is not just a biography, but a text that is true, nigh on holy, in its faithful depiction of Muhammad’s life. This is why Islamic historians, theologians, as well as lawyers, and various religious teachers have relied on it in the past and still continue to do so today”.

The aforementioned text, the contents of which significantly influence relations between Islam and Judaism, including their attempts at dialogue, even today, comprises two motifs. The first is Muhammad’s opposition to all Gods other than Allah. The other is his distrust, even open intolerance, towards Jews.

Before discussing this topic, it should first be acknowledged that the relationship between the prophet Muhammad and the Jews changed over time.

After a forced departure from Mecca in the year 622 CE (*Hijrah*), Muhammad settled in Medina and searched for a way to connect with the local people, a part of whom were three Jewish tribes. Muhammad drew up the *Constitution* (agreement, contract) of the newly created religious community into which he wanted to include the Jews as well. Ibn Ishaq (2004, p. 231) writes, that Muhammad “made a friendly agreement with the Jews and established them in their religion and their property”. According to Ishaq (2004, p. 233), the *Constitution* also includes the following: “The Jews of B. Auf are one community with the believers (the Jews have their religion and the Muslims have theirs) (...) The Jews must bear their expenses and the Muslims their expenses. Each must help the other against anyone who attacks the people of this document. (...) The Jews must pay

with the believers so long as war lasts. (...) If any dispute or controversy likely to cause trouble should arise it must be referred to God and to Muhammad the apostle of God”.

Although the *Constitution* declares friendship between individual classes and groups of Medinan society, not all of them accepted the fact that Muhammad – as *God’s Prophet* – had a dominant position within the *Constitution* (as well as in Medinan society). For example, the inhabitants of Medina were only allowed to fight in wars with his ‘permission’, etc. Ibn Ishaq’s (2004, p. 239) comment on this situation follows: “About this time the Jewish rabbis showed hostility to the apostle in envy (...) because God had chosen His apostle from the Arabs. They were joined by men from al-Aus and al-Khazraj who had obstinately clung to their heathen religion”.

It could thus be said that Muhammad was also trying to convert Medinan Jews to his religion, yet when they refused to submit to his will, he reconsidered his initial view. As soon as he had won the *Battle of Badr* (624 CE), he aimed his wrath at his past *allies*, i.e., the Jews of Medina and its vicinity, whom he also suspected of collaborating with the Meccan enemies of the Muslims.

A tragic fate then befell the Jewish tribe of Banu Qurayzah. Muhammad and his army laid siege to their compound until they surrendered. Afterwards, he bid them one more time to accept Islam. When they refused to convert, all men of this tribe were sentenced to death and executed one by one.

Ibn Ishaq (2004, pp. 461-466) describes this event as follows: “When the apostle approached their forts he said, ‘You brothers of monkeys, has God disgraced you and brought His vengeance upon you?’ (...) Then they surrendered, and the apostle confined them in Medina in the quarter of d. al-Harith, a woman of B. al-Najjar. Then the apostle went out to the market of Medina (which is still its market today) and dug trenches in it. Then he sent for them and struck off their heads in those trenches as they were brought to him in batches. (...) There were 600 or 700 in all (...) Aisha said: ‘Only one of their women was killed. She was actually with me and was talking with me and laughing immoderately as the apostle was killing her men in the market (...) She was taken away and beheaded. I shall never forget my wonder at her good spirits and her loud laughter when all the time she knew that she would be killed.’ (...) Then the apostle divided the property, wives, and children of B. Qurayzah among the Muslims, and he made known on that day the shares of horse and men, and took out the fifth”. The famous theologian Hans Küng (2006, p. 152), whose sympathies towards Islam are undeniable, also observed that Muhammad’s “settling of accounts” with the Jewish tribe of Banu Qurayzah amounted to an “ethnic cleansing”, etc. It should at least be touched on that there are two interpretations of this event. One of them, so-called ‘apologetic’, states that Muhammad was not responsible for the aforementioned tragic fate of Medinan Jews. On the contrary, he reportedly signed ‘the first peace treaty in history’ with them, etc. The other, so-called ‘critical’, interpretation considers Muhammad responsible for the deportation and slaughter of Medinan Jews. Both of them explain his conduct as motivated by the collaboration of Medinan Jews and Meccan enemies of the Muslims.

It is surely not by accident that Muhammad’s last injunction as he lies on his deathbed is “Let not two religions be left in the Arabian peninsula” (Ishaq 2004, p. 689).

In spite of these obstacles to interreligious dialogue, it should be said that said dialogue is necessary simply because it has no (positive and constructive) alternative.

This also fully applies to Muslim-Christian dialogue, the ideological and ‘methodological’ basis of which can be neither *Islamophobia* nor *Islamotrivialization*.

While the supporters of *Islamophobia* cast doubt on the significance of this dialogue, supporters of *Islamotrivialization* consider it a ‘successful’ tool for overcoming any negative

consequences of immigration from the countries of Islamic civilization. In the present-day Europe, supporters of *Islamotrivialization* appear to be winning. They give credit for the success of the Muslim-Christian dialogue to the 'common origin' of these religions, as well as the assumed shared identity of Allah, Yahweh, and the 'trine' Christian God. Another argument that is often used is that Islam acknowledges Jesus (as a prophet) and shows his mother, Mary, respect, etc.

However, the above mentioned arguments find themselves greatly opposed by both Muslim and Christian writers. To illustrate objections from the perspective of Islamic exegetists of the *Quran*, here is a statement expressed by Ali Dashti at the end of the 20th century. In his work titled *23 Years: A Study of the Prophetic Career of Muhammad*, Dashti (1985, p. 113), at least diplomatically, refuses the claim that Islam emerged – just as Christianity – from 'the religion of Abraham', as well as the claim of Allah's shared identity with the biblical God of the Jews and Christians. A similar objection – from the perspective of Christianity – was expressed by Lukáš Lhoťan (2015, p. 39), who completely refuses any arguments for an analogy or even identification of Jesus with Muhammad.

Both the arguments of supporters of *Islamophobia* and those of supporters of *Islamotrivialization* sound like pseudo-arguments that in the (tense) present-day climate act more as obstructions to meaningful Muslim-Christian dialogue than as guides for their mutual getting to know one another and eventually developing a truly tolerant form of coexistence. This fact should not be forgotten by the present and 'future Europe' either.

It had already been stated that religious dialogue can only fulfil its function assuming that it is realized on the basis of a certain 'cognitive preparation'. The participants of the dialogue should know, or they should at least have elementary information about, one another. In other words, the Muslim representatives should have an undistorted view of the causes of the present-day wave of Islamophobia in some non-Muslims. The representatives of non-Muslims should have some conception of the causes of entire groups of Muslims turning to a fundamentalistic interpretation of Islam, or to extremist practices of its enforcement, also in the non-Muslim world, even if it results in 'suicide attacks'.

According to the results of research conducted by J. L. Esposito and D. Mogahed (2008, p. 69) in 2007, "only" 7% of the world's Muslim population considers the Al Qaeda attacks committed on 11th September 2001 "justifiable", while 93% of Muslims reject terrorism – even when "motivated by religion". It is unfortunate that sociological research of this type is only sporadic and partial.

This is probably one of the reasons why this goal was chosen in 2007 by the representatives of the Muslim world with the intention to develop interreligious dialogue. More than three hundred intellectuals (academics, writers, artists, scientists and religious activists) signed a document (*open letter*) named *A Common Word between Us and You*, which encourages representatives of Christianity to engage in dialogue. The basic (content and thematic) outline of the dialogue is comprised of "love of God" and "love of the neighbour". On 4th to 6th November 2008, the signatories of this document met with the pope Benedict XVI in the Vatican and together they established conditions for the conception of a "Catholic-Muslim forum". These are all 'signs of hope', which in the current relations between Christians and Muslims allow for overcoming tension and creating an atmosphere of mutual understanding, respect and acknowledgement of 'differences that do not cause conflict'.

In relation to disputes between Catholics and Muslims, it should be said that Francis of Assisi (1182-1226) was one of the first to suggest dialogue as a way of resolving these disputes. It is a well-known fact that this saint took part in the fifth Crusade as a missionary. After the particularly bloody Battle of Damietta (at the mouth of the river Nile), St. Francis – at his own risk – visited the camp of the leader of Muslim forces, the sultan of

Egypt Malik al-Kamil, and preached to the sultan about the teachings of Jesus Christ. Partially thanks to the agreeable nature of the Sultan, St. Francis' mission developed into what was – most likely – the first 'peace dialogue' of a Catholic and a Muslim. He was treated as an honoured guest and the sultan, deeply moved by his words, offered him lavish gifts before his departure. All along, it had been Francis' intention to stop the fighting altogether, but unfortunately, the main representative of the Catholics on this crusade, Cardinal Pelagius, ultimately refused the sultan's peace proposal (Moses 2009). Similarly to this, the Christian Holy Roman Emperor Frederick II (1194 – 1250) led the sixth Crusade and won Jerusalem without bloodshed (through parley) on the condition that the Muslims be allowed free access to their holy places in Jerusalem.

The Roman pope Francis derives the meaning of dialogue, as a form of communication between people, from the ability (and Christian duty) of a person to "build bridges of understanding and peace". In a homily given on 24th January 2014 in the chapel of the Domus Sanctae Marthae, he also stated that "dialogue is difficult, yet compared to attempting to build a bridge with an enemy, it is far worse to build a wall and to allow resentment to grow in one's heart. To humble oneself means to build a bridge. It is not easy. Yet Jesus did so, humbling himself to the outmost, he showed us the way. It is important to strive for reconciliation as soon as possible, whether through word or action. Better a bridge than a wall! One such as that which divided Berlin for many years (...) Even in our hearts, the Berlin wall can grow in our relationships with others (...) It is necessary to engage in dialogue, because over time, the wall grows higher just as weed grows that impedes the growth of wheat" (TKKBS 2014).

We concur with the opinion of Vladimír Tarasovič (2010, pp. 8-9), who states that: "dialogue of cultures (...) and religions (...) should be a key tool for the prevention of conflict, as well as for post-conflict reconciliation. Without intercultural, but also interreligious and interethnic dialogue, tensions could reach the point where one side could choose to solve existing problems through violence". This solution would be the worst and perhaps the most 'self-destructive' in relation to all parties involved.

4 When Does Interreligious Dialogue Stand a Chance of Succeeding?

In his time, Raymond Aron (1962, p. 200) wrote that "Politicians have not yet discovered the secret of avoiding violence". We suspect that this 'secret' can – under certain circumstances – be hidden within dialogue of rival parties. (Regardless of what the cause of their enmity may be.) Violence should not be the 'solution', not even when it is perpetrated in the name of some 'historical' or even 'absolute' truth.

The famous French humanist, lawyer, philosopher, and politician Jean Bodin (2008) was well aware of this when he, at the end of 16th century, i.e., in the atmosphere of religious intolerance, violence, and war, wrote – as if it were his *spiritual testament* – the dialogue *Heptaplomeres*, also known as *Colloquium of the Seven about Secrets of the Sublime*. The participants of the discussion are a Catholic, a Jew, a Muslim, a Lutheran, a Calvinist, a Sceptic, and a philosophical naturalist. The discussion is conducted in a calm and tolerant manner because its participants – on the basis of 'rejecting' fanaticism – search for (and find) what connects them (in spite of their differences) together.

The connections between interreligious dialogue and results of natural sciences research (M. Planck, S. Hawking, A. Vilenkin, J. Krempaský etc.) are discussed by the Slovak philosopher Marián Ambrozy (2015) in his thought-provoking study, *Foundations of Natural Sciences and Their Significance for the Dialogue of Cultures in the World*.

Taking into consideration all of the aforementioned facts, once more we would like to express the conviction that a meaningful, just and effective interreligious dialogue of the above stated

religions is possible simply because it is necessary. As it stands, its chances of success depend on it:

- being led from the position of (and within the bounds of) mutual acknowledgement, respect, and tolerance,
- being a joint effort to search for answers to questions which are important to all parties involved (i.e., present-day issues such as war conflicts, the environmental crisis, and the looming global – *social* and *natural* – catastrophe),
- being a joint effort to search for what *connects* the participants of the dialogue (as it is not possible to convince one whose belief is the polar opposite of one's own),
- guaranteeing freedom of thought and therefore right to one's own opinion, while – just as one side is *free to express* it, so is the other *free to reject* it,
- being a *space* for mutual consideration, providing evidence, verifying, and based on that also accepting or refusing the presented opinions and stances,
- being realized in a cultured manner,
- respecting the previously established – content and thematic – 'boundaries',
- not being *formal*,
- fulfilling the so-called "preventive function", i.e., preventing conflicts between religions, etc.

We would like to express the belief that all three 'Abrahamic religions' contain *forces* or groups of *devotees* (followers) capable of and willing to hold such a dialogue. It should be taken into consideration that the verses of holy texts can be – in a world of plurality of interpretation – subjected to diverse translations and readings, such as: historic-contextual, literal, metaphorical, etc.

A good example of this is the conception of dialogue of civilizations and religions, the author of which is a representative of Christian thought named Hans Köchler. This conception is supported primarily by his pioneering work *Force or Dialogue: Conflicting Paradigms of World Order*. Especially significant – in our opinion – are two parts of this work called *Philosophy and the Meaning of Interfaith Dialogue* and *Dialogue among Civilizations and Religions* (Köchler 2015).

In a similar way, the options for dialogue between 'Abrahamic religions' are discussed, at least tangentially, by some representatives of Islam in Europe, such as Ahmad M. Hemaya. In his work *Islam: A Profound Insight*, this imam and main official adjudicator for Muslim family matters in Germany states, that: "Islam considers differences between people an opportunity for getting to know one another and becoming closer (...) maintaining religious freedom is a strong principle in Islam (...) a Muslim must not punish a heterodox person for not being Muslim (...) people are not forced to believe (...) all people are equal – regardless of skin colour and nationality (...) murder is one of the most serious crimes (...)" etc. (Hemaya 2012, pp. 308, 309, 310, 341).

Muhammad Shahrour (2018) holds an analogous opinion about this issue. This can be seen mainly in his work named *Islam and Humanity: Consequences of a Contemporary Reading*, which includes 'dialogic chapters', such as: *The Citizen and Loyalty to Islam*, *The Meaning of Community, People and Nation*, and *Loyalty to Islam is Loyalty to Human Values*.

All these are signs of hope and reasons in favour of a tolerant coexistence of people with different religious and value orientations. A requirement for fulfilling this hope is mutual communication, willingness, and ability to engage in dialogue. In relation to this, it should be emphasized that a discussion that is not also comprised of 'freely resonating' dissenting opinions is not (and cannot be) seen as a part of meaningful dialogue. This fully applies to interfaith dialogue as well. Every human, as a being who is *thinking, free, and responsible*, has the option as well as responsibility to be the creator and participant of such a dialogue, which is ultimately nothing but their most intrinsic *cultural* creation and performance.

5 Present-Day Religious Dialogue and So-Called 'Global Ethic'

In present-day interfaith dialogue, the topic of 'universal' or 'global ethic' is becoming more and more popular. It is concerned with determining what could become the collective *spiritual dimension* of all the world's religions. In relation to this, it should be remembered that at the end of the last century, the *Parliament of the World's Religions* issued an official declaration called *Towards a Global Ethic: An Initial Declaration*.

It would seem that the main reason for this act was the conviction of its participants that conflicts were dangerously escalating around the world, a problem in which some devotees of world's religions play their part. The aforementioned declaration states: "Time and again we see leaders and members of religions incite aggression, fanaticism, hate, and xenophobia—even inspire and legitimize violent and bloody conflicts. Religion often is misused for purely power-political goals, including war. We are filled with disgust" (PWR 2020, p. 3).

In our opinion, the *Declaration* is a vision that could not only inspire interreligious dialogue but also suggest common ground for its participants, which is inferred from the value and spiritual commensurability of their catechistic beliefs and their attitudes in practice.

Interfaith dialogue can effectively contribute to a meaningful search for 'universal' or 'global ethic'. The first condition for the success of this dialogue lies in the representatives of world's religions relinquishing their belief in the *superiority* of their religion. In short: it is unacceptable and impolite to 'force' one's value system (including one's own form of faith) upon those who prefer different value systems and other forms of faith. In the search for 'universal ethic', the representatives of world's religions should always keep in mind that the *heart* of a person, where – according to Kant – 'moral law' lies, is (a priori) neither Christian, nor Jewish, nor Buddhist, nor Muslim, nor Confucian, nor Taoist... it is *human*. Although the 'world of people' may be comprised of a plurality of cultural and religious perspectives, this heart represents an anthropologically specific *unity*.

In relation to what was previously stated, one possible topic for interfaith dialogue could be a vision of so-called "universal religion" or "religion of the spirit", which had already been introduced in the middle of the 20th century by the *philosopher president*, Sarvepalli Radhakrishnan (he was appointed Spalding Professor of Eastern Religion and Ethic at University of Oxford in 1936, which made him the first Indian professor in Oxford (Murty and Vohra 1990, p. 81); additionally, in the years 1962-1967, he was the president of the Republic of India).

Ideological-methodological foundations of the vision of "religion of the spirit" can be inferred even from Radhakrishnan's understanding of the history of philosophy and religion: "the history of Indian thought illustrates the endless quest of the mind, ever old, ever new", while "the problems of religion stimulate the philosophic spirit (...) the supremacy of religion and of social tradition in life does not hamper the free pursuit of philosophy..." etc. (Radhakrishnan 1923, pp. 25-27).

The logical as well as spiritual consequence of his religious-idealistic monism is "a cordial harmony between God and man", which is characteristic of the relationship between God and the whole world, because: just as man was made by God, so was the world, they both exist within his embrace and they are revitalized through the spirit of God, "who alone is independent (svatantra)" (Radhakrishnan 1923, pp. 40-41).

The leitmotif of his vision of "religion of the spirit" is the conviction that *global unity of humanity with a spiritual* (religious and philosophical) *basis* is necessary. The Slovak philosopher and interpreter of Radhakrishnan's vision, Dalimír Hajko (2008, p. 191), states that it is: "an interesting contribution to solving global issues regarding the present and future of

humanity”, and “a magnificent attempt at unifying all poles of human existence – from mystic perceptions though morality to solving concrete problems of social life”.

The vision of “religion of the spirit” had the potential to become a *universal* conception that would contribute to unification of humanity based on a reinterpreted *spiritual* (and moral) *principle*. This *principle*, however, cannot have the character of traditional religious dogmatism. Radhakrishnan was convinced that dogmatic religions are divorced from the real social and spiritual life of the people. His vision of a ‘new religion’ is linked to tolerant *spirituality* and not intolerant *dogmatism*.

With regard to what was mentioned above, the “religion of the spirit” could be presented as a *new* idea platform for dialogue not only of respective religions, but also of entire cultures, with the purpose and goal of this dialogue being prevention of conflict. “Religion of the spirit” respects the need for faith, freedom, justice, and happiness of each person, regardless of which *cultural sphere* their existence is anchored in. In other words: “religion of the spirit” respects all forms and aspects of humanism. People are – according to it – *equal* not just before law, but also before God, they are extended *equal* human nature and respect... etc.

In his vision of the “religion of spirit”, S. Radhakrishnan does not try to avoid the sensitive question of comprehending God, including comprehending God in his ‘human form’. In this context, the following passage from his work, *Recovery of Faith*, is often cited: “by God-men we mean persons like Gautama the Buddha, Jesus the Christ (...) God-men are the precursors of the truly human. What is possible for a Gautama or a Jesus is possible for every human being. The nature of man receives its fulfilment in them. They are our elder brothers. They show us what humanity is capable of” (Radhakrishnan 1956, pp. 178-179).

This understanding of God logically overcomes antagonism resulting from one-sided absolutization of God’s transcendence or immanence; however, this does not necessarily lead to universal religious convergence, or even integration. Quite the opposite! It can further deepen existing differences between dogmatic religions. It should also be kept in mind that, in interfaith dialogue, *concrete* understanding of God should be considered a *topic* (or *matter*) not up for discussion!!!

In any case, it holds true that all initiatives (including the previously discussed vision of S. Radhakrishnan) concerned with searching for what unites respective religions have their place in present-day dialogue of religions and cultures. The purpose of this dialogue is perfecting the capabilities of their mutual communication. Mutual communication is what the level of their knowledge about one another is dependent on, and this knowledge is in turn the basis for their mutual respect and beneficial cooperation. Without mutual cooperation of respective cultures and civilizations (including cooperation of respective religions of the world), the fate of humanity – on our ‘blue planet’ – remains uncertain.

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THE FORMS OF APPEAL IN THE LINGUISTIC LANDSCAPE

^aALENA ĎURICOVÁ

Department of German Studies, Faculty of Arts, Matej Bel University, Tajovského 40, 96001 Banská Bystrica, Slovak Republic
 email: ^aalena.duricova@umb.sk

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Abstract: This paper reflects the research aim and starting points of the APVV-18-0115 project entitled *Language in the City – Documenting the Multimodal Semiosphere of Linguistic Landscapes in Slovakia and in a Comparative Perspective*. As formulated by its main author, Wolfgang Schulze (2018), the presented interdisciplinary project is focused on “the general research paradigms of the so-called cultural linguistics, sociolinguistics, multimodal linguistics, and cultural semiotics.” Within this context, the paper addresses the means used to express appeal in the linguistic landscape (order, ban, instruction, warning, request, or plea). The author draws on the characteristics and functions of imperative and its competitive forms in the German language, and observes their manifestations in the linguistic landscape. The analysis of the grammatical structures used for expressing the appeal deals with the material collected during the field research performed in the specifically selected parts of Erlangen, Germany. For the purpose of this analysis, the research material was complemented by the signs collected in the more frequented parts of Erlangen as well, i.e., places with increased movement and concentration of people such as the railway station, public transportation vehicles, malls, university, university library. The goal of this paper is to outline the means used in the German linguistic landscape to express an appeal and guide the behaviour of the intended recipients. The comparative perspective is applied not only in the examination and analysis of the research sample, but it also extends to the Slovak language. The results of the analysis are compared with the way an appeal is expressed in the Slovak linguistic landscape.

Keywords: linguistic landscape, communication, imperative, competitive forms of the imperative, German language, comparative perspective

1 Introduction

According to the well-known and frequently cited definition, “the language of public road signs, advertising billboards, street names, place names, commercial shop signs, and public signs on government buildings combines to form the linguistic landscape of a given territory, region, or urban agglomeration” (Landry – Bourhis 1997, p. 25), linguistic landscape can be briefly defined as a set of texts fixated on a variety of signs located in a region. These texts are complex and multimodal; besides the linguistic elements, they also contain metadata.¹ Schulze (2018) emphasizes their multimodality when he characterises the linguistic landscape as public urban communication, i.e., public texts consisting of both linguistic and non-linguistic signs. Therefore, it can be stated that the linguistic landscape takes the form of signs.

In terms of linguistic landscape research, it is useful to consider the diachronic perspective, i.e., the changes over time. The linguistic landscape is dynamic just like the language itself – it is dynamically changing, evolving, adapting, being enriched, modernised, and internationalised.

The linguistic landscape speaks to us – it addresses, informs, educates, influences, guides and instructs us, it offers us services and goods, and entices us to accept the offer – it communicates with us in a broad variety of ways.

The human communication processes are the foundation of social contact and common activities, which are taking place in different communication situations; each of them can be characterised as a different constellation of factors such as the number of communication participants, their social and communication roles, their relationships, the communication space, the observation of different objects within this space and their importance for the course of communication, but also the time and duration of communication including its development over time (Hoffmannová 1997).

Communication within a linguistic landscape is a specific phenomenon. The basic communication scheme: A → T → R (= author → text → recipient) applies to the communication within a linguistic landscape as well. In the perception of communication within a linguistic landscape, the elements of communication have a distinctive position. The author of the text remains in the background, they may be unknown or unmentioned, and the significant role is played by the text in its complexity, addressed to an essentially infinite set of recipients. Gašová (2022, p. 15) defines communication and the communication partners within a linguistic landscape as follows: “*How the communicative partners function: the linguistic landscape is represented by a particular sign while the recipient of the linguistic landscape represents the primary target group. [...] “The process of communication itself is associated with the transmission of information – conveying of some (intended) message to the recipient through a sign.”*”

This study draws on the theory of linguistic landscape communication. It investigates and analyses the signs, which convey an appeal, i.e., a variety of orders, bans, instructions, warnings, requests, pleas, which aim to guide the recipient’s behaviour, i.e., the recipient is expected to respect the information conveyed. The goal of this study is to characterise the selected portion of linguistic landscape from the viewpoint of the means used to achieve the communication goals, thus expanding our research project by another aspect. So far, the research team focused on the cognitive-cultural aspect (Dobřík 2021, 2022), diversity (Gašová 2021), multimodality (Lauková 2020; Molnárová 2022), increased expressiveness (Krško 2020), gender-neutral language (Štefaňáková 2020, 2022; Jesenská 2022), multilingualism (Lauková, Tóth, Istók, Lőrincz 2022), and the diachronic changes to the linguistic landscape (Bajusová 2021; Krško 2021; Molnárová 2020; Istók, Lőrincz, Tóth 2021). A complex view of the linguistic landscape can be found in the monograph authored by Istók, Lőrincz, and Tóth titled *Jazyková krajina miest Komárno a Komárom* (2022), which addresses a number of aspects and investigates the selected locations using the comparative method.

2 Material and methods

The material consists of the selected signs documented within the research project entitled *Language in the City – Documenting the Multimodal Semiosphere of Linguistic Landscapes in Slovakia and in a Comparative Perspective*, i.e., it was collected using field research. This study is focused specifically on the regulative discourse² represented by signs consisting of linguistic and non-linguistic signs documented in the selected parts of Erlangen, Germany. These signs convey appeals targeted at the broad public. Besides the signs collected in the specific location demarcated within the city (Hauptstraße), further material located outside this area will be examined and analysed for the purpose of comparison. These signs are similar and located in Erlangen as well, specifically in and around the railway station, malls, university, university library, and public transport vehicles. It is assumed that in these places, public behaviour needs to be guided; therefore, the occurrence of signs relevant for this study can be expected there. Since this research draws on multimodality as a significant attribute of the linguistic landscape and is focused on the forms of imperative or in other words, appeal, both linguistic and non-linguistic signs will be analysed.

The results of the examination and analysis will be subsequently compared with the way appeal is expressed in the Slovak linguistic landscape.

¹ For more information on the classification and characteristics of these aspects, see Gašová (2021).

² Ferenčík (2015) specifies the regulative discourse as a criterion for the linguistic landscape research in his study dealing with English in the visual semiotics of the urban linguistic landscape. Compare Ferenčík (2014).

We are drawing on the theoretical characteristics of imperative and its competitive forms in German.

The forms of imperative and appeal in the communication with the public, documented within the selected portion of the linguistic landscape, will be investigated using the methods of analysis and comparison. The theoretical foundation will be explained using descriptive methods.

3 Appeal from the grammatical point of view

In the German language, an appeal addressed to one or more persons takes the form of an imperative. "An appeal can take the form of plea, request, instruction, order, etc." (Duden 1984, p. 175, Helbig, Buscha 1996, p. 207). However, besides the imperative itself, German also offers competitive forms. They include mainly syntactic and lexical means. "In the syntactic competing forms, the appeal is additionally marked graphically by an exclamation mark and in articulation, by an emphatic accent." The most used competitive forms include:

- modal infinitive with the preposition "zu", e.g., Die Verursacher sind aufgefordert, ihr Malheur (Nudeln, Mais, Soße (?)) umgehend zu beseitigen,
- reduced sentences using
 - the infinitive, e.g., *Einsteigen!*,
 - participles, e.g., *Aufgepasst!*,
 - different word classes such as nouns or adjectives, e.g., *Vorsicht!, Achtung!*
- passive structures, e.g., Widerrechtlich geparkte Fahrzeuge werden kostenpflichtig abgeschleppt,
- modal and other verbs conveying an appeal, e.g., Neben Mehrweg- können Sie alle pfandpflichtigen Einwegverpackungen hier zurückgeben.

4 Analysis and its results

The forms of appeal, i.e., the use of imperative and its competitive forms was investigated in a sample of 176 signs in German located in the selected location of Erlangen (Hauptstraße), at/around the railway station, malls, university, university library, and in/on public transportation vehicles. Most of these signs were multimodal. As it was already pointed out, the language of the linguistic landscape comprises more than just text. Therefore, the analysed signs are perceived as multimodal semiotic objects within the linguistic landscape.

The 176 items in the sample were categorised based on the occurrence of imperative and its competitive forms:

4.1 Imperative – third person plural (formal): 25

In this category of appeals, the recipient was directly addressed ten times (verehrte Kunden, sehr geehrte Kunden, werter Kunde, werte Gäste, werte Besucher), in three cases, the recipient was thanked, and in three cases, the author of the text was listed. E.g.:

- Verehrte Kunden, bitte nehmen Sie ihren Einkaufswagen bereits vom Parkdeck in den Verkaufsraum mit
- Bitte benutzen Sie die gekennzeichneten Raucherbereiche. Vielen Dank für Ihr Verständnis und Ihre Mitwirkung. Ihr Bahnhofsteam
- Bitte bieten Sie diesen Platz körperlich beeinträchtigten Fahrgästen an

4.2 Competitive forms

As for the competitive forms of imperative, the infinitive, nouns, and participles were the most frequent. The frequency of occurrence and examples of appeals are listed below. In this context, it is necessary to point out the use of the exclamation mark. The exclamation mark was used in thirteen cases only; in two cases, triple exclamation marks were used for greater emphasis. Besides these forms of appeal, usually conveying a ban, order, or warning, familiar symbols, signs, and images were

also used. The appeals are often emphasized by the symbolic use of colour, e.g., ban – red, warning – yellow, order – blue; typography, e.g. capital letters, bold, size, underlining, arrangement, and as for punctuation, the exclamation mark.

- Infinitive or infinitive + negative (nicht, kein): 62
 - Bitte keine Ware in den Markt nehmen
 - Ausfahrt Tag und Nacht freihalten
 - Garage. Einfahrt freihalten.
 - Achtung noch nicht anfahren. Bremsen prüfen. Bitte losfahren.
 - Aufzug im Brandfall nicht benutzen
 - Nicht öffnen bevor der Zug hält.
 - Behinderteneingang. Bitte keine Fahrräder abstellen
 - Achtung! Fahrräder bitte nicht vor dem Schaufenster abstellen!
 - Bitte 1 Meter Abstand halten. Wartungsarbeiten. Danke!!!



Figure 1: Multimodality and synonymy of signs banning people from parking their bicycles in the specific spot.

- Infinitive with the preposition "zu" combined with other elements: 1
 - ACHTUNG. RUTSCHGEFAHR Die Verursacher sind aufgefordert, ihr Malheur (Nudeln, Mais, Soße (?)) **umgehend** zu beseitigen.
- Noun and noun + the pronoun "kein": 24
 - Nur Fluchttür. Kein Ausgang
 - Kein Verzehr von mitgebrachten Speisen und Getränken!
 - PC für Studienzwecke, keine Privatnutzung
- Noun + passive verb: 14
 - Überkleben, Beschädigen, Entfernen wird strafrechtlich verfolgt.
 - Jeder Ladendiebstahl wird angezeigt. Für jeden Ladendiebstahl wird ein befristetes Hausverbot ausgesprochen.
 - Wir weisen noch mal darauf hin, dass im Treppenhaus unbedingt auf Ruhe geachtet wird.
 - RUHE! Hier wird gearbeitet!
- Noun + adjective: 7
 - Notbremse. Missbrauch strafbar
 - Kartenzahlung erst ab 10,00 € möglich. Danke für Ihr Verständnis
- Participle: 14
 - Werbung einwerfen im Haus verboten
 - Bekleben streng verboten!!!
 - Unterhaltung mit dem Fahrer während der Fahrt untersagt!
 - Fahrradfahren an Werktagen erlaubt.
 - Fahrräder ablehnen oder abstellen verboten!
- Participle + verb "sein": 13
 - Elektrischer Betriebsraum. Der Zutritt ist nur befugten Personen gestattet
 - Unbefugten Personen ist der Zutritt nicht gestattet
- Modal verb: 3
 - Neben Mehrweg- können Sie alle pfandpflichtigen Einwegverpackungen hier zurückgeben
 - Wir dürfen hier nicht rein!



Figure 2: Multimodality and synonymy of signs mediating a ban using a modal verb

- Modal verb + passive infinitive: 2
 - Die Bücher aus dem Handapparat *sollen* ausschließlich im Aufsichtsbereich *gelesen werden* und *dürfen* nur kurzfristig (max. 30 Min.) gegen Vorlage des Studienausweises zum Kopieren *mitgenommen werden*.
 - Druckgasbetriebene Fahrzeuge *dürfen* nicht hier *abgestellt werden*.
- Other forms: 8
 - Wer Fahrzeuge beschmiert oder beschädigt, schadet allen
 - Wir weisen noch mal darauf hin, dass im Treppenhaus unbedingt auf Ruhe geachtet wird. Laute Unterhaltungen stören die Arbeit in den Lesebereichen ungemein. Telefonieren per Handy nur außerhalb der Bibliothek. Danke. In Namen aller Benutzer.
 - Privatparkplatz! Widerrechtlich geparkte Fahrzeuge werden kostenpflichtig abgeschleppt

Based on the analysis, it can be concluded that the use of imperative, specifically the 3rd person plural, is a polite way to convey an appeal or request, usually accompanied by the word “please”. The politeness can be emphasized by addressing the recipient and thanking them. Instead of a ban (Rauchen verboten – Smoking forbidden), a polite request is used (Bitte benutzen Sie die gekennzeichneten Raucherbereiche. Vielen Dank für Ihr Verständnis und Ihre Mitwirkung.) In all cases where the imperative (3rd person plural) was used, the recipients were addressed directly, i.e., these forms are not impersonal. As for the competitive forms of imperative, the most frequently used structures can be seen as “templates” into which specific words can be inserted, e.g.

- negative + infinitive (nicht parken, nicht öffnen),
- negative + noun (Kein Ausgang, keine Privatnutzung),
- noun + infinitive conveying an order (Ruhe bewahren, Ausfahrt freihalten),
- noun + negative + infinitive conveying a ban (Zutritt nicht gestattet, Aushänge bitte nicht entfernen),
- noun + participle/adjective (Betreten nicht gestattet, Bekleben streng verboten!).

The productiveness of the most frequent language means conveying an appeal in German is supported by the fact that they are used as synonyms for conveying the same appeal. The ban on smoking takes the form of imperative, infinitive, noun, or substantive plus adjective and participle. Parallels can be found in the parking bans (except for the imperative). Signs related to parking offer instructions on the possibility and methods of parking (with a parking ticket, free of charge, in marked spaces, ban on parking in a handicapped space) or warn in case of non-compliance with the ban or order (e.g. the vehicle will be towed away). In other words, both bans and orders are used.

The imperative constructions conveying the ban on smoking:

- *Bitte benutzen Sie die gekennzeichneten Raucherbereiche. Vielen Dank für Ihr Verständnis und Ihre Mitwirkung. Ihr Bahnhofsteam*
- *Raucherfreier Bahnhof. Zur Verbesserung der Sauberkeit und aus Rücksichtnahme auf Nichtraucher ist das Rauchen auf diesem Bahnhof grundsätzlich nicht gestattet*
- *Ab hier nicht mehr rauchen*

- *Achtung Rauchen verboten*
- *Hier gilt absolutes Raucherverbot*
- *Rauchen ist nur in gekennzeichneten Raucherzonen erlaubt*



Figure 3: Multimodality and synonymy of signs mediating a smoking ban

The imperative constructions conveying the ban on parking or parking instructions:

- Parkplatz! Widerrechtlich geparkte Fahrzeuge werden kostenpflichtig abgeschleppt
- Privatgrundstück. Nutzung nur mit Genehmigung des Eigentümers
- Privatgrundstück. Durchfahrt nur mit Parkgenehmigung. Für LKW gesperrt
- Privatgrundstück. Parken verboten. Widerrechtlich geparkte Fahrzeuge werden kostenpflichtig abgeschleppt
- Garage. Einfahrt freihalten
- Ausfahrt Tag und Nacht freihalten
- Mit Parkschein. Parken in gekennzeichneten Flächen erlaubt
- PARKSCHEINAUTOMAT Hier Parkschein lösen
- Achtung vorwärts einparken
- Ab 20 €1 Std kostenlos parken.



Figure 4: Multimodality and synonymy of signs mediating the ban on parking or parking or parking conditions

The documented material proves that an appeal can take the form of non-linguistic signs, i.e., symbols, and still be comprehensible. Symbols are useful in the regulative discourse since they are international and comprehensible for foreigners as well. For example, the symbols of smoking or parking bans in the figures above. Many similar symbols appeared in the linguistic landscape during the *COVID-19 (SARS-CoV-2)* pandemic. In Erlangen they conveyed the appeals (orders) related to the compliance with the anti-pandemic measures, most frequently wearing masks and respirators, and maintaining distance from other people.

The documented material shows the richness of the linguistic landscape and the use of synonymous signs conveying an appeal and guiding the recipients' behaviour. Besides the synonymous appeals, signs can have divergent functions based on their location. For example, the signs on the public transport vehicles. The location of these signs, for example, the sticker on the front of the bus, fulfils an informative function – it informs about the transportation possibilities for passengers as well as objects, e.g., the transportation of the physically disabled persons using wheelchairs or babies in prams. Placing them on or around the door turns them into orders, e.g., an order to use a specific door.



Figure 5: Sign homonymy – the informative and command functions of symbols

5 Conclusion

Based on the analysis and comparison of the linguistic and non-linguistic signs conveying appeals in German and the identification of the most frequent structures, it can be stated that the dynamics and variety of language in the linguistic landscape manifests in the communication with the public, specifically with the goal to guide people's behaviour. It also reflects in the synonymy of signs, which expands the selection.

The linguistic and non-linguistic signs in the linguistic landscape, which convey an appeal (ban, order, instruction, warning, request, or plea), are part of the regulative discourse. They are functionally combined and complemented, which reflects in their multimodality. A broad variety of signs and functions is used. As for the language means, the imperative and its competitive forms are frequent. The non-linguistic signs mainly take the form of symbols, pictograms, icons, typography, and colours. The appeals – bans and orders – are emphasized using the symbolism of colours, font size, bold, capital letters, arrangement on the sign, underlining, strike-through, or exclamation marks. Another way to emphasize an appeal is a warning specifying the consequences of non-compliance. The investigated material often included the sign (icon) of warning that illegally parked cars will be towed.

The analysis and comparison of the investigated signs pointed out the parallel use of multiple appeals on a single sign, i.e., the linguistic signs are complemented by one or more non-linguistic signs. For example, "Illegally parked vehicles will be towed for a fee" is complemented by a no-parking road sign and an icon showing a towed car.

The comparison with the Slovak language showed certain differences resulting from the differences of the languages and cultures. Besides the imperative forms, Slovak prefers the following competitive forms to convey an appeal: (Pozor výjazd, neparkovať), the noun *zákaz/ban* (ZÁKAZ PARKOVANIA, ZÁKAZ FAJČENIA), or the adjective *zakázané/banned* (FAJČIŤ zakázané, FAJČENIE ZAKÁZANÉ). Similar to the German samples, Slovak samples also use non-linguistic signs such as symbols, typography, and colours. The ban on bicycle parking in Erlangen points out a cultural difference between Germany and Slovakia. Due to the difference in the tradition of bicycle use in Germany vs. Slovakia, this type of sign is rare in Slovakia (in Banská Bystrica, which was part of the area investigated within this project, no such sign was found).

This paper presented the linguistic and non-linguistic signs conveying an appeal with the aim to guide the recipients' behaviour in the German linguistic landscape. The results of this analysis and comparison can be useful in translating appeals from Slovak into English. The preferred productive competitive forms of the imperative can be used as a template for the translation of tourism-related appeals and in places frequented by tourists.

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Primary Paper Section: A

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TEACHERS AND THEIR COMPETENCES IN THE PREVENTION OF PROBLEM AND RISKY BEHAVIOUR OF PUPILS

^aINGRID EMMEROVÁ, ^bTOMÁŠ JABLONSKÝ

*Faculty of Education, Department of Pedagogy and Psychology,
Hrabovská cesta 1, 034 01 Ružomberok, Slovakia
email: ^aingrid.emmerova@ku.sk, ^btomas.jablonsky@ku.sk*

This article is a partial output of the project KEGA 012KU-4/2022 Safety of School Environment – New Challenge for the Development of Selected competences of Primary and Secondary School Teachers

Abstract: The study deals with the competences and real possibilities of primary and secondary school teachers in the implementation of prevention of problem and risky behaviour of pupils. It also looks at the current state of problem and risky behaviour among primary and secondary school pupils. Effective school prevention, in which the teacher plays an important role, contributes significantly to the creation of a safe school environment.

Key words: problem and risky behaviour of pupils, prevention of behavioural problems, teacher as an implementer of prevention in school

Introduction

School, especially primary school, has a special status as it is attended by the entire population from the age of 6 years, with rare exceptions. It is therefore essential to implement prevention in school and to deal effectively with any manifestations of problem behaviour among pupils.

Skácelová (2003) points to the important role of the school in prevention, as it can ensure that preventive activities are included and pupils participate in them through its planned approach and influence on the pupil. In this context, she emphasises:

- the pupil spends a quarter to a third of a day at school, so the school greatly influences his/her lifestyle and the way he/she makes decisions,
- first serious problems in pupils' behaviour that require specialist care most often appear in primary school,
- the Department of Education has an extensive network of advisory services,
- pupils present first signs of problem behaviour usually before they get under the care of social curatorship,
- social and healthcare institutions provide assistance when intervention in the family is necessary and mostly when comprehensive preventive activities initiated by school institutions have not been sufficiently effective,
- school and school facilities are often the only environment in which positive peer influence can be systematically corrected, especially against disorganised individuals.

We can agree with Hanuliaková (2016), that the school environment provides opportunities to cultivate pupils' resilience and perseverance. For children and youth who have impoverished and stressful home environments, the school environment is very important, and school should provide them with a sense of accomplishment that is important to a child's self-esteem. The compensatory function of the school environment is important for every pupil; the school must provide a sense of belonging, a sense of achievement and a support for self-esteem. Similarly, Jedlička et al. (2004) state that for a minor or adolescent, socially disoriented and emotionally deprived from the family environment, the only hope is often the school, especially a personally mature and professionally motivated teacher, motivated to help his/her pupils.

Dulovics (2022a) defines the main tasks of the school in the field of prevention of online risky behaviour of pupils as follows (we add that they also apply to other types of risky behaviour of pupils): to encourage pupils to use the internet safely, to make pupils aware of the risks that can result from their reckless and ill-considered actions in virtual space, to guide pupils to respect the rules of respectful behaviour also in online communication,

to teach pupils how to react and act if they become a victim of cyberbullying or encounter other forms of virtual threat, to create a positive school climate and a space for open and friendly communication, to encourage pro-social behaviour and empathy in pupils - both in real and virtual space, to develop pupils' abilities to resolve interpersonal conflicts in an appropriate way, to develop pupils' critical thinking skills, to inform pupils about whom they can contact for help if they encounter something in virtual space that worries them.

1 The current state of pupils' problem behaviour and the necessity of school prevention

The issue of risky or problem behaviour of pupils (in terms of occurrence, forms, causes, as well as prevention and solution) has received theoretical and empirical attention for several years, in Slovakia and abroad (e.g. Emmerová, 2022; Niklová, Dulovics, Stehlíková, 2022; and others).

On the basis of partial intermediate results of our research conducted with primary and secondary school teachers within the KEGA project, we can conclude that teachers currently register the following very common manifestations of problem behaviour:

1. aggressive behaviour of pupils and bullying,
2. risky behaviour connected with online environment, especially cyberbullying,
3. use of legal drugs,
4. truancy.

These results correspond with the findings of the Ministry of the Interior of the Slovak Republic, which carried out a questionnaire survey in primary and secondary schools in 2021 in order to find out the real situation in terms of the occurrence of socio-pathological phenomena. The results show that smoking, truancy and bullying are the top three most common negative behaviours among pupils. Cyberbullying, violence among pupils and vandalism were also highly represented. The increase in aggressive behaviour of pupils is now becoming a serious problem, which is also confirmed by the results of other researches (Holguin-Alvarez et al., 2020; Patah et al. 2022). According to Winding, Aust and Andersen (2022), pupils' aggressive behaviour influences teachers' stress and burnout.

Experts, in connection with cyber environment and cyberbullying in particular, point out another risk, which is body shaming (e.g. Dulovics, 2022b, Židová, Kurincová, Turzák, 2022 and others). It arises as a negative consequence of the presented ideal of beauty, especially through social networks. Those who deviate from the ideal and the trend are humiliated, which can escalate to bullying or cyberbullying.

Poláková and Čonková (2021) point to the risks of the online environment as the possibility of drawing information from various sources, but often unverified, choosing entertainment programs (and not to educate oneself), the risk of becoming addicted, the excessive use of modern technology changes the personality, concentration is reduced, and the negative impact is also passivity in thinking and decision-making. According to Pasternáková (2019), social networks suppress the authority of parents and educators in a negative sense; uncontrolled and unrestricted use can lead to psychosomatic problems, it can cause problems with socialization, communication, obesity, addiction, health problems, etc. Vanková and Henželová (2022) include among the most significant negative phenomena the following: internet addiction, bullying, viewing sites with toxic content, defamatory speech and intolerance, false fraudulent messages and conspiracies, radicalisation, communication with unknown people via the internet, distribution of child pornography, sexting and cybergrooming.

A serious risk is that excessive use of the internet can develop into highly addictive behaviour (internet addiction). Excessive use of the internet may lead to complications in various areas of life. Excessive use of the internet is more prevalent among children and young people. The addictive risks of internet have been pointed out by e.g. Hupková (2022) or Niklová, Ševčík, Šimšřková (2022).

The anonymous environment of the internet also puts children and young people at risk of sexually risky behaviour. Sexting and sextortion pose real risks for both adolescents and teenagers, as confirmed by the results of several studies (Barrense-Dias, Chok, Stadelmann, Berchtold, Suris, 2022; Frankel, Bass, Patterson, Dai, Brown, 2018; Hollá, 2020; Mori, Park, Temple, Madigan, 2022; Wals, Tener, 2022; Wolak, Finkelhor, Walsh, Treitman, 2018).

2 The teacher and his/her competences in the prevention of risky and problem behaviour of pupils

The staffing of prevention in schools, i.e. the implementers of prevention, plays an important role. Prevention can be carried out by pedagogical and specialist school employees. We will focus on the roles and realistic possibilities of a school teaching staff in prevention. A current challenge in contemporary school practice is the readiness of the teaching staff to implement effective prevention as well as to address behavioural problems adequately.

Based on the intermediate results of our research within the KEGA project, we can conclude that teachers in practice are not adequately prepared for the implementation of prevention and resolution of behavioural problems with their pupils. In identifying their educational needs, they have shown interest in exactly those areas. According to Rovňanová (2015), as many as 73.8% of teachers feel subjective deficiencies and the need to improve by further education in the field of prevention and correction of risky behaviour. What is striking is that the situation has worsened based on the intermediate results of our current research.

According to Hasajová (2016), teachers support socio-moral development of pupils based on:

1. Acceptance of basic psycho-social values that are essential for human coexistence (this includes respect, support for mental and physical functioning, social order built on the basis of social coexistence and social cooperation).
2. Meeting pupils' needs for motivation and learning (pupils have choice and creative space in the learning process).
3. Ascertaining the state of discipline in the classroom, identifying various forms and severity of inappropriate behaviour. Systematic management of the prevention and correction of unwanted behaviour in the classroom.

The competency profile of a primary and lower secondary school teacher, and an upper secondary school teacher includes:

- to have basic practical experience in recognising socio-pathological manifestations of pupils' behaviour,
- to know the risks of socio-pathological phenomena and the possibilities of primary prevention and correction,
- to recognise socio-pathological manifestations of pupils' behaviour,
- purposefully includes primary prevention of socially pathological phenomena activities in the classroom,
- detects manifestations of socially pathological behaviour, actively cooperates with the pupil's legal representatives and professionals (colleagues) to eliminate them,
- evaluates the effectiveness of interventions (solutions) in eliminating socio-pathological phenomena in cooperation with the pupil's legal representatives.

Act No. 138/2019 on pedagogical and professional staff defines the career position of school coordinator in education and training. In current school practice in Slovakia, the weight of

responsibility for the implementation of prevention rests on their shoulders - they are the teachers who usually teach full-time. The coordinator in education and training coordinates the primary prevention of drug addictions and other socio-pathological phenomena, cross-cutting themes determined by the school education programme or informing and education through information and communication technologies. The coordinator should coordinate prevention activities in the school and should also cooperate with prevention, counselling and other professional institutions; the coordinator in education and training is certainly not the only implementer of prevention in a school.

From an educational point of view, the function of the class teacher is important, as he or she plays an important role in both preventing and dealing with problem or risky behaviour. The class teacher has many responsibilities and performs various functions or tasks, e.g. education, training, management, organisation, coordination and integration, activation, control, diagnosis, etc. The class teacher has the best insight into pupils' behaviour and their family environment and also the right conditions for preventive action on pupils during classroom lessons. He also cooperates with pupils' families and other teaching and professional staff in the school. The classroom lesson is intended for direct educational influence of the class teacher on the personality of the pupil. The aim of the classroom lesson is also to solve educational and educational problems and activities in the classroom, thus providing a space for preventive activities.

In the conditions of primary and secondary schools, the teacher can best and most often influence pupils within primary prevention in the classroom, in classes of ethics and religion, in classes of natural science and biology, history, and social studies. There is also space in other lessons where the curriculum thematically allows it. The preventive dimension of physical education is pointed out by Bartfk (2012), according to whom it contributes to the prevention of civilizational diseases, the development and formation of positive attitudes of pupils and at the same time it is a means of health and social prevention. He particularly emphasises the contribution of physical education and sports activities in the prevention of drug addiction, and of course there is a positive impact on other types of risky or problem behaviour as well.

In the prevention of problem behaviour of pupils, the teacher in the educational process, according to Lipnická (2022), strives to:

- to balance the educational influences in the family and at school, to help the pupil to compensate for the negative consequences of family education in the school environment (e.g. if the pupil does not have suitable conditions to prepare for school in the family environment, the teacher compensates for these negatives with other types of educational tasks at school and does not punish the pupil, if the pupil has a language deficit - the family uses a language code that is different to the language of instruction at school, the teacher chooses specific methods of eliminating the language deficit in the pupil's learning performance, etc.), coercion and disregard for the pupil's individual circumstances can trigger negative emotions and problem behaviour in the child in relation to both - the school and the teacher;
- always arouse the pupil's interest and alternate learning activities, so that the pupil does not perceive them as an obligation to learn and memorize what has been learned, but as an attractive path to further active cognition in the varied processing and expression of knowledge in the curriculum; knowing less is sometimes more than having a negative attitude towards the curriculum, the classroom and the teacher;
- being a natural authority for the pupil, an example of humanity, professionalism, honesty and fairness, at the same time being an emotionally balanced personality that is patient, calm, fair, but demanding on the child's behaviour and learning; being a model of a democratic and

humane personality for children is much better than lecturing them daily on the rules of behaviour;

- inform the pupils (verbally and visually) about the sequence of activities throughout the day, so that they can orient themselves in time and follow-up duties, reduce the learning load, alternate educational methods and forms of work, include frequent movement and relaxation activities, because a one-sided and prolonged load triggers unwanted reactions and behavioural manifestations that relieve the pupil's tension and stress;
- not to react at all costs to problematic behaviour of pupils, to rise above some minor manifestations of problem behaviour is sometimes better than constant warning, criticism, lecturing, which deprive the teacher of enthusiasm and optimism in the profession and the pupils of interest in working with such a teacher.

Preventive work with a group of pupils as a priority appears to be effective. The advantages of preventive work with a group of pupils include the use of group dynamics, socialisation of group members, social learning and the promotion of pupils' social development. Group relations have an impact on the individual and influencing group relations leads to improved school climate and educational process. Preventive work with a group of pupils increases understanding and appreciation for the feelings of classmates, pupils can be taught that expressing feelings has communicative value, they practise open and functional communication, they understand that people can have different opinions on things.

In the context of prevention, the most frequent group of pupils in the school to work with is a class. As Sokolová (2022) notes, effective programmes in the field of prevention, as well as personal and social development, rely mainly on long-term work with the group, using elements of social dynamics and group interaction, while using a wide range of methods.

Within the framework of non-specific prevention, all teachers can act and influence the pupil's personality in the direction of the desired development. According to Jablonský (2017), interpersonal skills, such as the ability to communicate and work in a team, are increasingly important. Within the framework of preventive activities, school action should be aimed at developing pupils' social competences with regard to effective problem solving and developing social communication.

3 Conclusion

School, as a professional institution, ensures the implementation of prevention, especially primary prevention and, since problem behaviour is widespread among pupils, also secondary prevention. Secondary prevention involves comprehensive care for pupils with problem behaviour, from educational problems in the family, through breaches of school rules, to breaches of the provisions of the legislation in force.

The requirement for permanent training of teachers in the field of prevention and dealing with risky behaviour of pupils is becoming extremely topical; they should participate in training activities and purposefully develop their competences.

Prevention must be implemented at a professional level. It is essential that education coordinators as well as other teachers actively participate in training activities and take an interest in new information in this field.

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Primary Paper Section: A

Secondary Paper Section: AM

FINANCIAL PERFORMANCE MEASUREMENT MODELS IN THE AUTOMOTIVE INDUSTRY IN SLOVAKIA

^aDOMINIKA FALISOVÁ, ^bJOZEF GLOVA, ^cALENA ANDREJOVSKÁ

Faculty of Economics, Technical University of Košice, Boženy Němcovej 32, 040 01 Košice, Slovak Republic;
email: ^adominika.falisova@tuke.sk, ^bjozef.glova@tuke.sk, ^calena.andrejovska@tuke.sk

This paper is a part of the research project of the Ministry of Education, Family and Sports of the Slovak Republic VEGA project No. 1/0673/21 Analysis of Economic Perspectives of Industry 4.0 in Terms of the Impact of Intangibles on the Profitability and Market Value of Industrial Companies

Abstract: The article deals with financial performance management in Slovakia's automotive industry. The aim of this article is to design models of financial performance in the automotive industry as a tool to increase the effectiveness of financial performance management with possible application in practice. The researched objects are companies operating in the automotive industry based in Slovakia. Mathematical, statistical, and econometric methods were used to fulfill the aim of the work.

Keywords: financial analysis, financial performance, traditional indicators of financial performance, modern indicators of financial performance

1 Introduction

The entry of the Slovak Republic into global markets brought many economic consequences and significant changes to companies operating on the domestic market, which can be divided into positive and negative changes. A positive change is the number of new business opportunities, which are often very closely linked to constant changes in the economic, financial, and legislative environment within the EU. In addition to many opportunities, this brings small and medium-sized enterprises operating on the Slovak market pitfalls, and if they want to overcome them, they must be flexible, constantly evaluate their financial performance and increase the efficiency and competitiveness of financial management.

Recently, there have been significant changes in approaches to evaluating the financial performance of companies on the global market. Transition from standard financial indicators and models that are based on accounting profit to financial models that consider economic profit, market value and market criteria for small and medium-sized enterprises is not so obvious. Despite the theoretical importance of the issue of financial management analysis, small business owners do not attach sufficient importance to it and pay attention to more standard absolute accounting indicators, such as economic results, costs, revenues, profitability, and indebtedness indicators.

The automotive industry has a strong tradition in Slovakia and became the most important sector and driving force of the Slovak economy. Over the past 20 years it has been an important source of foreign direct investment as well as industrial innovation. Slovakia can be considered as one of the key players of the global automotive industry.

2 Literature Review

In their research, the authors Kiseľáková and Šoltés (2017) devoted themselves to analysis and practical application financial performance management models of 40 small and medium-sized enterprises in the food industry in Slovakia and the Czech Republic, while monitoring the period from 2010 to 2014. Based on the empirical data obtained from the financial statement databases, they tried to perform a financial analysis, while they emphasized data on revenues, costs, ROA, ROE, economic or overall results indebtedness. To fulfill the set goal, they used time series analysis, regression analysis, and correlation analysis. In the trend analysis of some indicators, Kiseľáková and Šoltés focused on median values. Sub-analyses were devoted to trends in basic absolutes (sales, costs), difference (net working capital), as well as ratio indicators (ROS,

ROE). The overall analysis of the selected enterprises was carried out on two levels, and at the same time projected into two models:

1. SMFR model: EAT analysis (represented by management result),
2. MMFR model: EVA analysis (represented by a modern indicator of financial performance).

Based on the performed analysis, the authors concluded that it is suitable for the analyzed companies to use the SMFR model, which is based on the management result, as it is with the MMFR model it is necessary to know the value of the EVA indicator, the calculation of which is complicated. SMFR model evaluated as a prediction model, which confirmed that this is a real development trend of the selected indicators with an effort to decrease the absolute cost indicator and maximize net growth of working capital, growth of the sales indicator and return on equity. Monitored so businesses should focus on deeper analysis and monitoring of absolute indicators, in particular: the result of management, sales and costs.

Delen et al. (2013) also focused on measuring the financial performance of Turkish companies listed on the Istanbul Stock Exchange. The authors used decision tree analysis, while in their research used a two-stage analysis:

1. Exploratory Factor Analysis (EFA) through which they identified and verified basic dimensions of financial indicators,
2. Analysis of predictive modeling methods, which revealed potential relationships between company performance and financial indicators.

They used four algorithms to research the impact of financial indicators on the company's financial performance decision tree (CHAID, C5.0, QUEST and C&RT). These algorithms tested return on equity and return on assets using hold out samples. So that the authors can determine how well-run models on real-world data, created a subset of the data for testing purposes and verification. For this reason, the set of obtained data was divided into two parts, with 70% of the data was used to create the model and 30% to test it. They used to analyze the financial performance authors test data sets. The results of the analysis were also examined in two parts:

1. In the first part of the analysis, the coefficient of return on equity was the dependent variable (ROE),
2. In the second part of the analysis, the dependent variable was return on assets (ROA).

The result obtained using ROE as the dependent variable indicated that the most important financial indicators are profit and loss ratio before tax, net profit margin, financial leverage indicator and sales growth ratio. These variables had the greatest impact on predicting ROE. Research results pointed out that the pre-tax profit-loss ratio was the most important factor in each of the four models. Net profit margin emerged as the second most important ratio among the three (CHAID, C5.0 and QUEST) from four models. Evaluations from the second part of the analysis, where it was dependent with the ROA variable, they pointed out that the most important financial indicators include profit before by taxation, the share of net profit, the debt ratio and the ratio of asset turnover, which had the greatest impact on predicting ROA. The result also found that pre-tax profits on equity, net profit margin and debt ratio were the most important indicators in each of the four models. Further in the analysis, the authors tried to find out which financial indicators have the greatest impact on company performance. After the analysis, it was found that the most significant impact on performance companies have two profitability ratios, namely: profit before tax and net profit margin.

In their study, Wu and Shen (2013) focus on the relationship between the financial performance of a company and its social responsibility (CSR) in the banking sector. The motifs suggested that the relationship between these it is positive in two areas, namely that financial performance is influenced by social performance responsibility. The research sample covered the years 2003-2009 and consists of data from 162 banks in 22 countries. The authors then divided the banks into four categories based on their degree of involvement into social responsibility. To avoid data distortion, the study suggests using of the extended version of Heckman's two-stage regression:

- Step1: logit model,
- Step 2: estimates the performance equation with the inverse Mills ratio generated in the first step.

In Benková et al (2020), empirical results show that social responsibility is positively associated with financial performance in terms of return on assets, return on equity, net interest income and non-interest income. Conversely, social performance is negatively associated with non-performing loans, so it is strategic choice as the primary motive of banks to engage in social responsibility. If it is a matter of measures for making a profit, banks that carry out more activities in the field of corporate social responsibility outperform those that do not participate in social responsibility.

By linking CSR and financial performance in the banking sector, they also covered in their research Simpson and Kohers (2002). The aim of the work was to extend previous research on the relationship between CSR and financial performance of the company. A significant contribution of the study is the empirical analysis of the sample companies from the banking industry and the use of the rating. Empirical analysis strongly supports the hypothesis that the connection between social and financial performance is positive. Research sample they comprised all national banks that were reviewed for compliance in 1993 and 1994 with rating agencies. All banks that were assigned ratings were included in the sample necessary improvement. Banks that received satisfactory ratings were omitted for clarity division of banks with high social performance and low social performance. Finally, the total sample consisted of 385 banks. In monitoring financial performance, two measures were used, which the authors considered to be important measurement dimensions, namely the ROA indicator and the loss from loans to total loans. The authors used regression analysis where the null hypothesis of a negative relationship, or its non-existence between the rating and the return on assets was rejected on a probabilistic basis level 0.016, i.e., it is a positive regression coefficient for the rating variable. Regression equation with dependent variable (loan losses) and independent variable (rating) revealed that the null hypothesis could be rejected. Research results clearly indicate that there is a positive relationship between social and financial performance, which indicates better financial performance for banks with high social performance, i.e., banks with high social performance had lower loan losses.

The research of the Czech author Dluhošová (2004) deals with the analysis of financial performance based on of the modern EVA method. The research sample consists of 2,009 industrial enterprises in the Czech Republic in the observed period of 1997-2001. Based on the conducted study, it can be argued that decisive the positive development of the indicator is influenced by a decrease in the cost of equity capital, as well as growth of the EAT/EBIT indicator. On the other hand, the most significant negative impact was the increase of the own capital in relation to the negative value of EVA. The author further devoted herself to the decomposition of the EVA parameter, while using the logarithmic decomposition method. Research has shown that increasing the competitiveness of enterprises in the Czech industry will lead to the fact that the EVA indicator will gradually moves from negative to positive values. The author does not recommend using logarithmic analysis, but rather functional, or pyramid decomposition. Companies that achieved positive the value of EVA also increases with market capitalization, based on which Dluhošová comes to the

conclusion that the EVA method should be one of the key measures in managing the financial performance of the company as it is connected with the orientation of the company towards increasing the value for the owners.

In his research, Watson (2007) focuses on modeling the interaction between financial performance and building a network. Network theory comes with the view that a successful business can depend on the ability of owners to gain access to resources that are not under their control, and thus in a way that which is cost effective. Networks provide value to members by giving them access to social resources that are embedded in the network and thus the network can provide resources, with which owners of small and medium-sized enterprises can use the necessary resources (ie o resources acquired externally). However, there is currently little empirical support for this proposition, especially for established companies, while the results of the study are based on an extensive long-term database and indicate a significant positive relationship between networking and financial performance. Several studies have been conducted to examine the relationship between network connectivity and performance companies, but each of them had at least one of the following limitations:

- Only cross-sectional data were used.
- Only a limited number of networks were examined.
- Potential variables (age, industry, and company size) were not mentioned.

The aim of most studies was the research of emerging or newly established enterprises. Watson therefore in his study sought to explore and model the connection between networking and financial performance of companies (survival, growth, and ROE). 5,027 economic operators were included in the survey businesses from Australia and data collection was done through questionnaires over a period of years 1994-1998. This study tracks the performance of firms through three important measures:

- survival of the company,
- growth of total revenues (sales plus other revenues),
- return on capital (ROE).

It was used to evaluate the relationship between networking and these measures of firm performance binary logistic analysis. A strength of this study is the use of a large longitudinal database which allows several variables to be included in the analysis. The results suggest that networking and financial performance have a positive interaction. In terms of survival and growth, she could in this area there is some optimal level of resources that the owner should invest in networking. On the based on the study, it can be argued that while its results provide some support for network activities (mainly in the field of survival and growth of the company), it is not recommended that everyone's networks be developed and promoted species. The author further argues that the extensive involvement of owners in multiple networks will be Although the results suggest that the support of networks could be very beneficial if the goal is to maximize business growth and survival but support for networks is unlikely to be beneficial to the company's profitability (ROE).

Brazilian authors Viglioni et al. (2018) conducted research to identify the main economic and financial performance indicators of companies, or of mergers and acquisitions in technological industry in Brazil. The quantitative model was logistic regression, the research sample consisted of 28 enterprises of the industrial sector, the necessary data of which were collected and distributed quarterly between 2009 and 2017. While conducting the study, the authors found that studies related to this topic were extensively discussed, especially in the field of industrial economy, finance, and accounting. The created logistic regression model showed that the key economic and financial indicators that determine mergers and acquisitions in the technological industry depend on foreign capital, and the size of the company. Foreign capital is one of the alternatives through which the company finances its business activity. In turn,

company size can bring many advantages, for example, increase in assets, geographical expansion, economies of scale, greater bargaining power and other. One of the results of this survey points out that the company's profits can be increased compensated by an increase in the size of the company, i.e., a larger volume of own resources. Contradictory ROE, ROA, L3 and EVA recorded the result as they showed negative statistical significance and they generated value for shareholders. The authors made a proposal for future research, in more detail analyze the EVA, deepen, and expand the time frame of the research.

The aim of the research of the Czech author Pokorná (2012) was to find out whether the financial performance of Czech of companies with foreign capital shows higher financial performance than companies with domestic capital. The author had available data from 6,152 companies, while financial performance was measured on a five-year period from 2005-2009 based on significance profitability and asset growth. The financing of these enterprises was as follows:

- 32% of companies with foreign capital,
- 45% of companies' domestic capital,
- 23% of companies did not have this information available.

The difference between the financial performance of Czech companies with foreign and domestic capital was performed through the Mann-Whitney U test and the financial performance of the companies was measured through return on assets ROA and asset growth ratio. Research has found that in businesses with foreign capital, the average growth of assets was equal to 7.76% and the return on assets was 6.61%. The results for companies owned by the Czech Republic were 9.48% and 7.74%. The conclusions are statistically significant, and it can therefore be concluded that foreign-owned enterprises are not more efficient than domestic companies.

In research conducted by Hertenstein et al. (2005) investigated the question of whether there is a connection between industrial design and financial performance of the company, while the goal was to find out how it affects design for financial performance. 93 publicly traded companies were included in the examined sample companies, and the research covered the period from 1995 to 2001. The authors used traditional financial performance indicators (especially return on sales and return on assets), while expecting that businesses that place great emphasis on design have higher return on sales, ROA as well as rate sales growth. Furthermore, they assumed higher returns on the stock market and cash flow. On the other side also higher expenses that are associated with design (salaries of industrial designers, fees design consultants, industrially supported industries), but also material expenses and production. The authors performed this analysis using the Student's statistical method t-distribution where they tested the null hypothesis which assumes that there is a relationship between industrial design and financial performance. The results indicate that there is a positive relationship between these two areas, however, surprisingly revealed that companies rated as companies with "good" design they were stronger in all indicators except growth rate. These results provide evidence that good industrial design is related to financial performance.

The aim of the study by the author Závorská (2011) was to identify the relationships of financial indicators performance and subsequent selection of key identifiers. The research sample consisted of 344 cooperatives of enterprises that account in the double-entry bookkeeping system, while the data is from 2008. The author focused on the following 14 indicators:

- production power (EBIT/A),
- return on assets (EAT/A and EBT/A),
- return on equity (ROE),
- profitability of sales (EBIT/T and EAT/T),
- asset turnover (T/A),
- share of added value in sales (VA/T),
- share of added value on assets (VA/A),

- share of economic added value on net operating assets (EVA/NOA),
- total liquidity (L3),
- current liquidity (L2),
- ready liquidity (L1),
- insolvency.

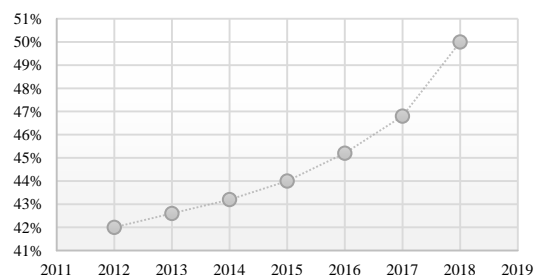
Statistical and logistic methods were used in the research. Individual financial indicators performance was calculated by the author using descriptive statistics, correlation analysis was used for the calculation The Kolmogorov-Smirnov test, which pointed out that for all 13 indicators (except of the T/A indicator) the null hypothesis of a normal distribution of the variable can be rejected. Executed the research produced the following result: Among the indicators that were examined, the author recommends leave the following:

- profitability indicators: EBIT/A, EBIT/T, VA/T, ROE,
- activity indicators: T/A,
- liquidity indicators: L3, insolvency,
- modern indicators: EVA/NOA.

3 Automotive industry in Slovakia

An analysis of the automobile industry was carried out, as it is a decisive industrial sector of the economy in Slovakia. Figure 1 shows how the share of the automotive industry in the total industrial production of Slovakia developed in the selected period 2012 to 2018. This share is increasing from year to year.

Figure 1 The share of the automotive industry in the total industrial production of Slovakia (2012 to 2018)



Source: own processing, Sario Agency

Based on available data from the Sario agency, we can claim that Slovakia is one of the countries that has held a leading position in the automotive industry in Central Europe since the 1990s. Over the past 20 years it has been an important source of foreign direct investment as well as industrial innovation. For this leading position we can thank the presence of four global car companies - Volkswagen Slovakia (Bratislava), Kia Slovakia (Žilina), Stellantis Slovakia (Trnava) and Jaguar Land Rover Slovakia (Nitra).

According to Trebuna et al. (2022), Slovakia is also a key player in the global automotive industry. As already mentioned, the automotive industry has a long tradition in Slovakia, and we can say that it is the driving force of the Slovak economy. Based on a survey by the Sario agency, the biggest advantages of Slovakia in the field of investment by automotive companies in this country include:

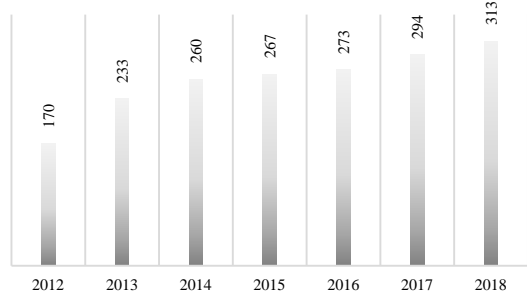
- strategic position within Europe,
- a wide network of suppliers,
- economic stability of the country,
- well-developed infrastructure,
- stable and favorable business environment,
- skilled and educated workforce,
- cost effectiveness,
- currency euro.

Every year, Slovakia improves its position on a global scale, as evidenced by the latest survey by the Sario agency, according to

which Slovakia is among the 20 largest producers of the automotive industry in the world with a production of more than 1 million cars per year. In 2021, this sector participates in the total industrial production of the country in the amount of 48%, while its share of the total GDP of the country represents 12%. People employed directly by the 4 car producers present 164,000 people and 245,000 people employed directly and indirectly by the automotive industry.

On the graph below (Figure 2) we can see the number of companies that were registered in Slovakia and belong to the automotive industry. Looking at the graph, we note that we recorded the largest number of companies in 2018, up to 313 companies.

Figure 2 Number of automobile industry enterprises in Slovakia (2012 to 2018)



Source: own processing, Finstat Database

4 Materials and Methodology

This section is devoted to the proposal of a financial performance model in the automotive industry as a tool leading to an increase in the effectiveness of financial performance management and its possible application in practice. The goal is to design a regression model, its subsequent estimation and interpretation.

The analytical and design part of the thesis is based on the financial data of automotive companies industry in Slovakia and for its needs we have chosen a statistical classification of economic activities SK NACE Rev. 2, sector C- production, division 29, which deals with the production of motor vehicles, trailers and semi-trailers, namely subgroups 29.10 (manufacture of motor vehicles), 29.20 (manufacture of bodies (coachwork) for motor vehicles and manufacture of semi-trailers and trailers) and 29.30 (manufacture of parts and accessories for motor vehicles). Financial data of companies in the automotive industry were obtained from Finstat database, as it provides financial data for many companies. The key period for our analysis was the years from 2012 to 2018, because available financial data were reported by companies in this period.

A trend analysis of traditional and modern financial was carried out indicators of 118 enterprises of the automotive industry in the period from 2012 to 2018. These enterprises they paid attention to most financial indicators, especially absolute financial ones an indicator of sales and costs, as well as a ratio indicator of profitability, liquidity, indebtedness, and activities. It should be emphasized that the financial statements did not contain the values of the EVA indicator, which it belongs to modern indicators of financial performance, which is why we quantified this indicator.

For this article, it was necessary to determine the variables which will enter our calculations as dependent, or independent. Since we are targeting the research on two models of financial performance for 2018, for each of them we they chose a different dependent variable that enters our model. We selected the explanatory variables as follow:

- traditional indicator of financial performance of EAT,
- modern EVA indicator.

The selection of independent variables was based on the results of the authors who dealt with the given issue in his previous studies. Most authors paid attention mainly to indicators return on equity (ROE), total liquidity (L3), indebtedness and sales. To us created and researched model, in addition to the above, we also included an absolute financial one cost indicator.

Table 1, it captures the variables that are used in our proposed and investigated models of financial performance of the company. The financial indicators representing the explanatory variables are therefore as follows:

Table 1 Dependent and Independent variables

	Variables		Unit of measure
y_1	EAT	Net profit	EUR
y_2	EVA	Economic Value Added	EUR
x_1	S	Sales	EUR
x_2	C	Costs	EUR
x_3	L3	Total Liquidity	coef.
x_4	I_d	Degree of indebtedness	%
x_5	ROE	Return On Equity	%

Source: own processing

The first step in the design of the model was to examine the influence of independent, i.e., explanatory variables (x) to the dependent, or explained variable (y) and for this purpose it was necessary create sub-models where the dependent variable always depended on only one independent variable, i.e., that we created as many sub-models as the variables were included in analysis.

To make estimates, it was necessary to analyze whether the model chosen by us is suitable and meets the assumptions of linear regression. We therefore tested the following assumptions:

- normality of the residuals,
- the presence of heteroscedasticity,
- the presence of autocorrelation,
- the presence of multicollinearity.

A significance level of 0.05 was compared with the p-values of all tests. Based on of the previous relationship were subsequently rejected or accepted null hypotheses.

Normality of residuals

Residues represent model errors, i.e., differences between the actual value of y_t and the model by the estimated value of y . According to the assumptions of linear regression, the residuals should come from a normal distribution. In our case, we used Jarques- Bera test of normality, while we tested the following hypotheses:

H0: The residuals come from a normal distribution.

H1: The residuals do not come from a normal distribution.

If the p-value of the test >0.05 , H0 is not rejected.

Presence of heteroskedasticity

Homoscedasticity appears in the model if the assumption of linear regression is met about constant variance. On the contrary, if this assumption is not met, it means a problem heteroskedasticity. To verify the presence of heteroscedasticity in the model, we applied Breusch-Pagan test, where we tested the following hypotheses:

H0: There is no heteroskedasticity in the model.

H1: Heteroskedasticity is present in the model.

If the p-value of the test > 0.05 , H0 is not rejected.

Presence of autocorrelation

The random components in a linear model should not be correlated. If this condition is not met, there is an autocorrelation problem in the model. The correlation is monitored by the correlation coefficient ρ , which can take on values from the

interval -1 to 1. Durbin–Watson test was used to test autocorrelation the test and hypotheses were formulated as follows:

H0: Autocorrelation is not present in the model ($\rho = 0$).
H1: Autocorrelation is present in the model ($\rho \neq 0$).

Acceptance, or the rejection of the hypotheses depended on the test statistic, which is calculated as twice the difference $1 - \rho$.

In case of:

$P = -1$, then the test statistic is 4, this represents negative autocorrelation,

$P = 1$, then the test statistic is 0, this represents positive autocorrelation,

$P = 0$, then the test statistic is 2, meaning no autocorrelation is present,

$-1 > P > 1$ and at the same time $P \neq 0$, then decisions are made based on critical values.

Presence of multicollinearity

Multicollinearity occurs in a model when there is a dependency between the dependent variables. In our case, the presence of multicollinearity in the model was detected using the inflation factor VIF test, where its values come from the interval 1 to infinity. Values greater than and equal to 5 indicate the presence of strong multicollinearity (Ringle et al., 2015). We tested the hypotheses:

H0: There is no dependence between the explanatory variables.

H1: There is a dependency between the explanatory variables.

5 Results and discussion

The first tested model was the standard model (SM), in which EAT appeared as the dependent variable.

The output from the R program in the form of the resulting values of all variables in the model is presented in Table 2, where statistically significant variables are also marked, through significance codes. Testing the assumptions of this standard linear regression model was performed subsequently.

Table 2 Linear regression model (SM) variable values

Independent variables	Estimation	Standard deviation	p-value
S	-0,01315	0,00245	1,06e-07***
C	-0,01076	0,00275	0,0001***
L3	-0,20271	0,02338	0,3861
Id	0,15501	0,01348	0,7209
ROE	0,48173	0,01325	0,9069
Significance codes	0 *** 0.001 ** 0.01 * 0.05 * 0.1		

Source: own processing, The Output of R program

The evaluation of the performed tests is summarized for the standard model in the following table (Table 3). Based on the performed testing, we interpret the results as follows:

1. Testing the normality of the residuals - the model meets the assumptions of the normality of the residuals, because $p > 0.05$. We do not reject the hypothesis H0, that the residuals come from a normal distribution.
2. Testing the presence of heteroskedasticity - there is no heteroskedasticity in the model since $p > 0.05$ applies. We do not reject the H0 hypothesis, which states that there is no heteroskedasticity in the model.
3. Testing the presence of autocorrelation - there is no autocorrelation in the model, $p > 0.05$ applies. We do not reject the hypothesis H0: There is no autocorrelation ($\rho = 0$) in the model.
4. Testing the presence of multicollinearity - the model meets the assumptions of independence of all independent variables because $p > 0.05$. We do not reject the H0 hypothesis about the absence of dependence between the explanatory variables.

Table 3 Results of SM linear regression model testing

Testing	Test	p-value	Test result
the normality of the residuals	Jarques – Bera test	0,7706	H0 do not reject
the presence of heteroskedasticity	Breusch – Pagan test	0,3695	H0 do not reject
the presence of autocorrelation	Durbin – Watson test	0,0568	H0 do not reject
the presence of multicollinearity	VIF test	1,3112	H0 do not reject
		1,3181	
		3,8519	
		1,1031	
		1,7671	

Source: own processing, The Output of R program

The second model tested was the modern model (MM), in which EVA appeared as a dependent variable.

The table below (Table 4) shows all the variables that enter the modern linear regression model - MM. Variables that demonstrate statistical significance are marked with the respective significance codes. Subsequently, testing was carried out to see if this model also meets the conditions of a linear model.

Table 4 Linear regression model (MM) variable values

Independent variables	Estimation	Standard deviation	p-value
ROE	0,406707	0,049093	0,0007***
S	-0,171592	0,032756	0,0016**
C	-0,181012	0,055447	0,0035**
L3	0,003746	0,021291	0,1768
Id	0,005229	0,024563	0,1972
Significance codes	0 *** 0.001 ** 0.01 * 0.05 * 0.1		

Source: own processing, The Output of R program

The evaluation of the tests that were carried out for the modern model is summarized in the following (Table 5). Based on the performed testing, we state the following:

1. Testing the normality of the residuals - the model meets the assumptions of the normality of the residuals, $p > 0.05$ applies. We do not reject the hypothesis H0: the residuals come from a normal distribution.

Table 5 Results of MM linear regression model testing

Testing	test	p-value	Test result
the normality of the residuals	Jarques – Bera test	0,6577	H0 do not reject
the presence of heteroskedasticity	Breusch – Pagan test	0,3681	H0 do not reject
the presence of autocorrelation	Durbin – Watson test	0,0524	H0 do not reject
the presence of multicollinearity	VIF test	2,3208	H0 do not reject
		2,5121	
		1,0819	
		1,1232	
		1,0235	

Source: own processing, The Output of R program

2. Testing the presence of heteroskedasticity - there is no heteroskedasticity in the model, because $p > 0.05$. We do not reject the H0 hypothesis about the absence of heteroskedasticity in the model.
3. Testing the presence of autocorrelation - there is no autocorrelation in the model, $p > 0.05$ applies. We do not reject the hypothesis H0: that there is no autocorrelation ($\rho = 0$) in the model.
4. Testing the presence of multicollinearity - assumptions about the independence of all independent variables are also met in the model because $p > 0.05$. We do not reject the H0 hypothesis, which assumes the absence of dependence between the explanatory variables.

Dependencies of financial indicators

The tested set contains 118 companies ($n=118$) and the significance level is set at 0.05 ($p=0.05$).

The evaluation of the statistical dependence between the selected indicators in 2018 is captured in the table (Table 6). After performing the significant significance test, statistical

dependence was found between modern EVA indicators and ROE indicators, also between EVA and absolute financial indicators of costs and sales. The P-values of these variables were less than 0.05, i.e., we reject the null hypothesis of the absence of statistical significance between the indicators. In the case of the degree of indebtedness and total liquidity, we accept the hypothesis H0 of the absence of dependence, because their p-value exceeds the significance level of 0.05.

Table 6 Evaluation of the statistical dependence between selected standard financial indicators and the EVA indicator in 2018

Spearman's correlation coefficient				
variables	r	t(n-2)	p-value	Testing result
EVA & ROE	0.17321199	1.8941815	0.0000041	+
EVA & Id	-0.1872096	-2.0525995	0.7027906	-
EVA & L3	-0.1622567	-1.7710272	0.5495236	-
EVA & C	-0.0804366	-0.8691449	0.0004881	+
EVA & S	-0.0750193	-0.8102656	0.0006731	+

Source: own processing, The Output of R program

Table 7 shows the results of the H0 hypothesis testing about the non-existence of statistics among the selected financial indicators in 2017. As we can see, this year too there is a statistically significant dependence between the indicators EVAROE and ROE, EVAROE and costs, but also EVA and sales, as their p-values did not exceed 0.05. We accept the null hypothesis only in the case of the relationship EVA and L3, as well as EVA and Id.

Table 7 Evaluation of the statistical dependence between selected standard financial indicators and the EVA indicator in 2017

Spearman's correlation coefficient				
variables	r	t(n-2)	p-value	Testing result
EVA & ROE	0.16797717	1.835246671	0.0000049	+
EVA & Id	0.01875402	0.201987304	0.7250151	-
EVA & L3	-0.1583752	-1.727556746	0.7030032	-
EVA & C	-0.0899127	-0.97232801	0.0004446	+
EVA & S	-0.0896273	-0.96921629	0.0004512	+

Source: own processing

By verifying the H0 hypothesis by correlation analysis in 2016 (Table 8), it was found that a statistically significant dependence between variables was recorded for the following pairs: EVA & ROE, EVA & costs and EVA & sales, whose p-values were lower than the significance level of 0.05. On the contrary, we accept the null hypothesis, which assumes the absence of dependence between the selected financial indicators, again for the pairs: EVA & L3 and EVA and Id, as their p-values exceeded the statutory significance level of 0.05.

Table 8 Evaluation of the statistical dependence between selected standard financial indicators and the EVA indicator in 2016

Spearman's correlation coefficient				
variables	r	t(n-2)	p-value	Testing result
EVA & ROE	0.15987713	1.7443673	0.0000068	+
EVA & Id	-0.0490467	-0.528886	0.7155107	-
EVA & L3	-0.0285251	-0.307350	0.3091502	-
EVA & C	-0.0523127	-0.564197	0.0007736	+
EVA & S	-0.0478132	-0.515554	0.0008932	+

Source: own processing

Statistical dependence testing in 2015 is shown in Table 9. We reject the H0 hypothesis about the absence of significant dependence between the variables in the case of pairs EVA & ROE, EVA & costs, as well as EVA & sales. The P-values of these pairs were very low and did not exceed the limit of 0.05, which indicates the existence of statistical significance between these indicators. On the contrary, the p-values of the pairs of variables EVA & Id, EVA & L3 were higher than the established significance level of 0.05, which indicates the absence of statistically significant dependence between the variables.

Table 9 Evaluation of the statistical dependence between selected standard financial indicators and the EVA indicator in 2015

Spearman's correlation coefficient				
variables	r	t(n-2)	p-value	Testing result
EVA & ROE	0.16087713	1.75556695	0.0000067	+
EVA & Id	0.08594147	0.92905525	0.8825264	-
EVA & L3	-0.0536204	-0.5783409	0.4386942	-
EVA & C	-0.0461229	-0.4972885	0.0006718	+
EVA & S	-0.0387241	-0.4173844	0.0007863	+

Source: own processing

In 2014, the statistical dependence between the selected indicators was tested again (Table 10). A significant statistical dependence was found between the pairs of indicators EVA & sales, EVA & costs and EVA & ROE. In these cases, we reject the H0 hypothesis since the significance level of 0.05 was not exceeded. In the case of the relations EVA and Id and EVA & L3, the p-values were higher, which indicates acceptance of the null hypothesis, which assumes the absence of dependence between the selected financial indicators.

Table 10 Evaluation of the statistical dependence between selected standard financial indicators and the EVA indicator in 2014

Spearman's correlation coefficient				
variables	r	t(n-2)	p-hodnota	Testing result
EVA & ROE	0.17144578	1.874279017	0.0000044	+
EVA & Id	-0.0455447	-0.49053643	0.7229416	-
EVA & L3	-0.0704425	-0.76057799	0.5223487	-
EVA & C	-0.0821602	-0.88789427	0.0004913	+
EVA & S	-0.0768941	-0.83063408	0.0005401	+

Source: own processing

The verification of hypotheses in 2013 is shown in Table 11, from which it follows that the p-values of the pairs EVA & L3, as well as EVA & Id were higher than the chosen significance level of 0.05, and thus we accept the null hypothesis, which assumes that there is no statistically significant dependence between the tested variables. In the other cases, the p-values did not exceed the significance level of 0.05, and therefore we reject the H0 hypothesis. Thus, we claim that a statistically significant dependence exists for pairs of financial indicators EVA & ROE, EVA & sales, and EVA & costs.

Table 11 Evaluation of the statistical dependence between selected standard financial indicators and the EVA indicator in 2013

Spearman's correlation coefficient				
variables	r	t(n-2)	p-hodnota	Testing result
EVA & ROE	0.177524335	1.94285511	0.0000021	+
EVA & Id	-0.03306782	-0.3563461	0.6815288	-
EVA & L3	0.09240012	0.99945546	0.7906354	-
EVA & C	-0.08300235	-0.8970581	0.0002147	+
EVA & S	-0.07885601	-0.8519582	0.0003429	+

Source: own processing

Hypothesis H₀, which assumes the absence of significant statistical dependence between selected financial indicators, was also tested in 2012 (Table 12). Correlation analysis found the dependence between the modern EVA indicator and the traditional ROE indicator, as well as the absolute indicators of sales and costs. For these pairs of variables, the p-values did not exceed the 0.05 threshold, and therefore we reject the H₀ hypothesis, claiming that there is a statistically significant dependence between the selected financial indicators. On the other hand, we do not reject the H₀ hypothesis for the remaining two pairs of variables.

Table 12 Evaluation of the statistical dependence between selected standard financial indicators and the EVA indicator in 2012

Spearman's correlation coefficient				
variables	r	t(n-2)	p-hodnota	Testing result
EVA & ROE	0.17530188	1.91775603	0.0000034	+
EVA & Id	0.08207355	0.88695154	0.8438169	-
EVA & L3	0.0773701	0.83580683	0.6360071	-
EVA & C	-0.0731297	-0.7897456	0.0003491	+
EVA & S	-0.0688742	-0.7435635	0.0004218	+

Source: own processing

We interpret the results of the performed regression analysis as follows: we accepted the H₀ hypothesis, which assumes the absence of a significant statistical dependence between the modern EVA indicator and selected standard financial performance indicators, for the pairs listed below:

- EVA & degree of indebtedness,
- EVA & total liquidity.

By means of the verification of the H₀ hypothesis, a significant statistical dependence was found in each of the monitored years between the following pairs of variables by correlation analysis:

- EVA & ROE,
- EVA & sales,
- EVA & costs.

Based on the performed testing, we also found that there is a positive relationship between the modern EVA financial performance indicator and the return on equity ROE indicator, in each analyzed year, which also results from the above-mentioned tables (Table 7 to Table 12). It also follows from the mentioned tables that there is a significant dependence between the EVA indicator and the absolute indicators of sales and costs, but in these cases this dependence is negative, while it was confirmed in every monitored year.

The verification of the H₀ hypothesis was subsequently also carried out for the entire period from 2012 to 2018 (Table 13). Also during this testing, a positive statistical dependence between the EVA & ROE indicators was demonstrated, a negative dependence was recorded for the pairs EVA & sales, EVA & costs. On the other hand, a statistically significant dependence was not confirmed between the indicators EVA & L3 and EVA & I_d.

Table 13 Evaluation of the statistical dependence between selected standard financial indicators and the EVA indicator throughout the period

Spearman's correlation coefficient				
variables	r	t(n-2)	p-hodnota	Testing result
EVA & ROE	0.40760173	4.80747787	0.0000001	+
EVA & I _d	-0.0723138	-0.7808789	0.5790183	-
EVA & L3	0.03518408	0.37917891	0.6019781	-
EVA & C	-0.2189302	-2.4165753	0.0000011	+
EVA & S	-0.1790234	-1.9597975	0.0000014	+

Source: own processing

Two linear regression models were proposed: the standard model and the modern model, which were subsequently estimated and interpreted results.

The first model was a standard SM linear regression model based on EAT analysis, which represented the dependent variable in this model of financial performance. This net indicator companies paid sufficient attention to profit and reported it in their financial statements in each observed period. After testing the assumptions of linear regression, confirmed the suitability of our chosen model. As statistically significant variables in this model they showed mainly sales and costs. In the case of sales, it is a positive relationship, and therefore with an increase in sales there is also an increase in EAT. Conversely, when costs increase, EAT decreases, which means negative addition.

Second, the modern MM model was based on the analysis of the modern EVA indicator, which was chosen as the dependent variable. It should be emphasized that not a single enterprise showed the values of this modern indicator, and therefore it was necessary to quantify it. The values had to be calculated for everyone one company separately. As mentioned above, the calculation of the EVA indicator is considerable complicated and its calculation requires the calculation of other variables, such as cost of equity capital. This is also most likely one of the reasons why him companies do not pay attention and do not show it in their financial statements. The suitability of this of the model was also confirmed based on testing the assumptions of linear regression. Statistically significant variables in this model can be ROE, sales, and costs.

After conducting the tests of dependencies, a significant statistical dependence was found in each year between the dependent EVA and the independent variables ROE, costs, and sales.

The research that we studied before conducting our testing was devoted to companies' different industries, but we can say that the trend development of the EVA indicator was like the case of the automobile industry companies we examined.

Study of the food industry in the Czech Republic and Slovakia by Kiseřáková and Šoltés (2017) as well demonstrated a negative relationship between sales and the modern EVA indicator.

The relationship of the variables was investigated through the correlation coefficient. Dluhošová (2004) addressed in her research analysis of the financial performance of industrial enterprises in the Czech Republic based on modern EVA methods, while the decisive influence on the positive development of the indicator has a decrease in costs for equity, as well as the growth of the EAT/EBIT indicator.

On the other hand, the most significant negative impact had an increase in equity due to a negative EVA value. Viglioni et al. (2018) performed research of the technological sector in Brazil, while recording the opposite result of ROE, ROA, L3 and EVA because they showed negative statistical significance and generated shareholder values.

6 Conclusion

The article presents an analysis of the automotive industry in Slovakia in the years 2012 to 2018, capturing its development and basic characteristics. We worked with relevant data belonging to the statistical classification of economic activities SK NACE Rev. 2, sector C- production, section 29, which deals with the production of motor vehicles, trailers, and semi-trailers. The key period for our analysis was the years 2012 to 2018, and since not all companies falling into our selected category provided the required financial indicators in their financial statements and annual reports, our resulting database contained 118 companies.

It was devoted to the design of the financial performance model in the automotive industry. The starting point for the models and their variables was, on the one hand, a trend analysis of the financial indicators of automobile industry companies, and on the other hand, the results of the authors who addressed the issue in their previous studies. The proposed regression models were subsequently estimated and interpreted, while an extensive mathematical and statistical apparatus was used. Econometric models were compiled using the R program and hypotheses were tested to see if there was a statistically significant dependence between the selected standard indicators and the modern indicator in each year.

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Primary Paper Section: A

Secondary Paper Section: AH

THE ROLE OF POWER DYNAMICS AND SOCIAL STATUS IN INDIAN MNCs IN SHAPING IN-GROUP AND OUT-GROUP BEHAVIOUR AND ITS IMPACT ON PERCEIVED INDIVIDUAL PERFORMANCE OUTCOMES

^aVIVEK KUMAR, ^bPARITOSH MISHRA, ^cSURAJ BHAN YADAV, ^dSANDEEP KUMAR GUPTA

^{a,b}Amity Business School, Amity University, Noida, India

^cJai Narain Vyas University, Jodhpur, India

^dCentre for Statistics, Modelling and Simulation,

AMET Business School, Faculty of Management Studies,

AMET University, Chennai, India

email: ^avivek.legalmanagement@gmail.com;

^bpmishra@amity.edu; ^csurajbhan.yadav.88@gmail.com;

^dskguptabhu@gmail.com

Abstract: Abstract needs to be written in English, Times New Roman, Font 6. The abstract should be no longer than 10 lines, alignment to blocks. **Abstract:** This research paper investigates the role of power dynamics and social status in shaping in-group and out-group behaviour in Indian Multinational Corporations (MNCs) and examines their impact on perceived individual performance outcomes. Using a qualitative and quantitative research approach, data is collected from employees in Indian MNCs and analysed through thematic and quantitative analysis to identify power dynamics and social status and explore their influence on in-group and out-group behaviour. The study assesses the impact of such behaviour on perceived individual performance outcomes, considering prior research highlighting its negative effects on employee engagement, job satisfaction, and overall organizational performance. The findings can help managers develop effective diversity management strategies, promoting an inclusive work environment and improving individual performance outcomes. The paper concludes by emphasizing the study's significance and potential contributions to theory and practice. By exploring the role of power dynamics and social status in shaping in-group and out-group behaviour and its impact on individual performance outcomes, this research offers valuable insights into the complexities of managing a diverse workforce in Indian MNCs

Keywords: Diversity Management, In-Group, Indian MNCs, Individual Performance Outcomes, Multicultural Environment, Out-Group, Power Dynamics, Social Status.

1 Introduction

Multinational corporations (MNCs) operating in India are faced with the challenge of managing a diverse workforce that consists of individuals with different cultural backgrounds, beliefs, and values. This is coupled with the fact that shifting global occupational trends are drawing MNCs towards local sensitivities or isomorphism (Mishra, Shukla & Sujatha, 2021). The presence of power dynamics and social status within these organizations further complicates the challenge of managing diversity. Power dynamics refer to the distribution and exercise of power within an organization, while social status refers to an individual's social position or rank within a group or society. These dynamics can significantly affect in-group and out-group behaviour, which can have a profound impact on the perception of individual performance outcomes.

In-group and out-group behaviour refers to the behaviour of individuals who identify with a particular group within an organization and those who do not identify with that group, respectively. This behaviour can have a profound impact on an individual's performance outcomes and the overall performance of the organization.

The study of power dynamics and social status in shaping in-group and out-group behaviour in Indian MNCs is of significant importance because it contributes to the understanding of diversity management in organizations. The findings of this study can be used to develop effective diversity management strategies in MNCs operating in India. Additionally, the study of in-group and out-group behaviour can have practical implications for managers who are responsible for managing teams in a multicultural environment.

This research paper tried to find answers to the following Research questions:

What is the nature of power dynamics and social status in Indian MNCs?

How do power dynamics and social status shape in-group and out-group behaviour in Indian MNCs?

What is the impact of in-group and out-group behaviour on perceived individual performance outcomes in Indian MNCs?

The objectives of this study are as follows:

To explore the nature of power dynamics and social status in Indian MNCs.

To examine how power dynamics and social status shape in-group and out-group behaviour in Indian MNCs.

To assess the impact of in-group and out-group behaviour on perceived individual performance outcomes in Indian MNCs.

This study is limited to MNCs operating in India and does not include other types of organizations. The study is also limited to the perceptions of employees working in MNCs in India. The study's scope is limited to the impact of power dynamics and social status on in-group and out-group behaviour and perceived individual performance outcomes.

2 Literature Review

In this section, we provide a review of the literature on in-group and out-group behaviour, power dynamics and social status in shaping in-group and out-group behaviour, the impact of in-group and out-group behaviour on perceived individual performance outcomes, theoretical frameworks for understanding in-group and out-group behaviour, and empirical studies on in-group and out-group behaviour.

In-group and out-group behaviour refer to the ways in which individuals within a group interact with each other based on their shared identity and the ways in which they interact with individuals who do not share the same identity. Tajfel and Turner (1979) define in-group as "a social category to which a person perceives himself or herself as belonging" and out-group as "a social category to which a person perceives himself or herself as not belonging".

Power dynamics and social status play a significant role in shaping in-group and out-group behaviour in organizations. Research has shown that individuals who hold higher positions in the organizational hierarchy are more likely to be included in the in-group, while those who hold lower positions are more likely to be excluded from the in-group (Hogg, 2001; Turner et al., 1987). Additionally, individuals who possess characteristics such as gender, race, and ethnicity that are consistent with the dominant group in the organization are more likely to be included in the in-group (Tajfel & Turner, 1986).

In-group and out-group behaviour can have a significant impact on individual performance outcomes. Research has shown that being included in the in-group can lead to higher levels of job satisfaction, organizational commitment, and performance outcomes (Hogg, 2001). Conversely, being excluded from the in-group can lead to lower levels of job satisfaction, organizational commitment, and performance outcomes (O'Reilly et al., 1991).

Several theoretical frameworks have been proposed to understand in-group and out-group behaviour. Social identity theory (Tajfel & Turner, 1986) proposes that individuals derive their sense of self from their membership in social groups and that this sense of self is tied to their perception of their in-group. Social dominance theory (Sidanius & Pratto, 1999) proposes that group-based hierarchies and power differentials are inherent in all societies and that individuals at the top of these hierarchies

are more likely to engage in discriminatory behaviour towards those at the bottom.

Numerous empirical studies have been conducted on in-group and out-group behaviour. For example, Hogg (2001) found that in-group inclusion predicted job satisfaction and organizational commitment, while out-group exclusion predicted job dissatisfaction and turnover intentions. Similarly, Ellemers et al. (2004) found that in-group members were more likely to receive favourable treatment and evaluations than out-group members. Additionally, several studies have explored the impact of power dynamics and social status on in-group and out-group behaviour (e.g., Turner et al., 1987; Tajfel & Turner, 1986).

Bardi, Buchanan, Goodwin, and Slabu (2014) investigated the influence of social norms on workplace behaviour and found that social norms have a powerful effect on shaping behaviour in the workplace. Their study demonstrated that employees are more likely to comply with norms that are perceived to be important by their colleagues, even if these norms go against their personal beliefs.

Chatman and O'Reilly (2014) argued for the need to reinvigorate the study of organizational culture and shift focus away from simplistic, static definitions of culture. They proposed a more dynamic approach to studying culture that takes into account the context in which it is embedded and acknowledges its potential for change.

Chang and Hsu (2019) examined the impact of social status on customer service behaviour in the context of retail sales and found that high-status employees are more likely to engage in prosocial behaviour towards customers. They also found that the positive effect of social status on customer service behavior is mediated by self-monitoring.

Chua and Gudykunst (2019) provided an overview of the role of culture in communication and highlighted the need for cross-cultural understanding in a globalized world. Their review emphasized the importance of recognizing cultural differences in communication styles and norms to effectively navigate intercultural interactions.

Connelly, Zweig, Webster, and Trougakos (2016) investigated the phenomenon of knowledge hiding in organizations and found that employees often hide knowledge from their colleagues for a variety of reasons, including self-protection and personal gain. They also found that the presence of a positive team climate can help reduce knowledge hiding.

Hsiung (2016) examined the relationship between social status and job performance in collectivistic cultures and found that the relationship is moderated by the level of autonomy provided to employees. Their study showed that social status has a positive effect on job performance in environments with low levels of autonomy, but this effect is reversed in environments with high levels of autonomy.

Jetten and Hornsey (2014) reviewed research on deviance and dissent in groups and highlighted the importance of understanding the social context in which deviance occurs. Their review emphasized the need to consider factors such as group identity and power dynamics in understanding deviance and dissent in groups.

Kark and Van Dijk (2015) examined the role of self-regulatory focus in leadership processes and found that leaders who focus on promotion goals (i.e., achieving gains and positive outcomes) are more likely to engage in transformational leadership behaviours, while leaders who focus on prevention goals (i.e., avoiding losses and negative outcomes) are more likely to engage in transactional leadership behaviours.

Kozlowski and Ilgen (2016) reviewed research on work groups and teams and identified key factors that contribute to their effectiveness, including task design, team composition, and team processes. They also highlighted the importance of considering

both individual and team-level factors in understanding group and team performance.

Leach, Ellemers, and Barreto (2017) provided an overview of the concepts of group identity and social identity and highlighted the importance of considering both individual and collective identities in understanding behaviour in social groups. Their review emphasized the dynamic nature of identity and the potential for identity to shift in response to changes in social context.

Power dynamics and social status play a significant role in shaping in-group and out-group behaviour in organizations. Li and Zhou (2017) investigated the role of leaders' power distance beliefs and subordinates' collectivism in determining subordinates' proactive behaviour. They found that when leaders held higher power distance beliefs, subordinates' collectivism was positively related to proactive behaviour.

Social status can also impact customer behaviour. Liu and Chen (2018) examined how social status affects customer tipping behaviour and found that customers with higher social status are more likely to leave larger tips than those with lower social status.

Lord and Dinh (2016) explored how leadership processes influence follower self-identity. They found that leaders have the ability to influence follower self-identity through the use of language and behaviours that signal identity-related messages.

Team identification can also impact perceptions of team performance and player effort. O'Neill et al. (2015) investigated the association between team identification and perceptions of team performance and player effort among university basketball fans. They found that higher levels of team identification were associated with more positive perceptions of team performance and player effort.

The emotional displays of leaders can impact team performance, depending on follower epistemic motivation. van Kleef et al. (2012) examined the effects of leader emotional displays on team performance and found that the impact depends on the level of follower epistemic motivation.

Emotion cycles can also impact team performance. Hareli and Rafaeli (2018) explored the effects of emotion cycles on team performance and found that teams with more positive emotion cycles had higher performance outcomes.

Telecommuting can impact performance through i-deals and job resources. Gajendran et al. (2015) investigated the effects of telecommuting on performance and found that telecommuting can have positive effects on performance through the creation of i-deals and job resources.

The relationship between leader-member exchange and employee outcomes can be moderated by power distance. Lu and Yuan (2018) investigated the effect of leader-member exchange on employee outcomes and found that power distance moderates the relationship, such that the effect is stronger for employees with lower power distance beliefs.

Kumar, Kapoor and Gupta (2022) investigated the question that whether the qualities of transformational leadership influence employees' job engagement and found out that transformational leader propagates their high power and enthusiasm to their workers through inspirational motivation to increase their engagement on the job.

Kniffin and Wilson (2010) explored the impact of nonphysical traits on the perception of physical attractiveness through three naturalistic studies. The study showed that nonphysical traits such as kindness, intelligence, and humour could enhance the perceived attractiveness of a person.

Baumeister and Leary (1995) examined the fundamental human motivation of the need to belong and the desire for interpersonal attachments. The authors proposed that the need to belong is a

primary motivation for human behaviour, and that social exclusion or rejection can have detrimental effects on individuals.

Gutek et al. (1996) investigated the reactions of individuals to perceived sex discrimination in the workplace. The authors found that reactions to perceived sex discrimination varied by gender, with women reporting more negative reactions to discrimination than men.

Tjosvold et al. (2014) studied the evolution of leader-member exchange theory and how it is associated with effective leadership. The authors highlighted the importance of relationships between leaders and subordinates in promoting trust, communication, and performance.

Lin and Cheng (2018) investigated the factors that drive team members to help each other in the context of work teams. The study revealed that team social identity and relational identification are strong predictors of helping behaviour among team members.

Zapf et al. (2017) conducted a representative study of working Germans to identify the typical characteristics of victims of workplace bullying. The authors found that victims of workplace bullying tended to be younger, have lower occupational positions, and have less job tenure.

Sinha et al. (2022) found out that many organizations have transitioned to Succession Planning being an agile process, that identifies and develops a pool of talented individuals who can assume future roles built around organization's vision; mission and business value system, which are competency driven.

Wildschut et al. (2006) explored the content, triggers, and functions of nostalgia. The authors found that nostalgia can be triggered by various factors such as personal and social transitions, and that nostalgia serves several functions, including increasing self-esteem, providing a sense of belonging, and promoting positive affect.

Rana, Kapoor and Gupta (2021) in their study concluded that companies implementing the HR practices based on employer branding and corporate social responsibility get benefits in building the corporate image and give positive results to them. HR practices have a significant relationship with corporate image building.

Brouer et al. (2016) examined the challenges associated with managing high-performance teams. The authors identified several challenges, including creating a shared vision, managing conflicts, and fostering a culture of trust and collaboration among team members.

Overall, these studies shed light on various aspects of human behaviour, including the impact of nonphysical traits on attractiveness, the fundamental human motivation of the need to belong, the effects of workplace discrimination, the importance of relationships between leaders and subordinates, the drivers of helping behaviour in work teams, the characteristics of victims of workplace bullying, the functions of nostalgia, and the challenges associated with managing high-performance teams. These findings have implications for understanding the role of power dynamics and social status in shaping in-group and out-group behaviours, as well as their impact on perceived individual performance outcomes in Indian MNCs. As pointed out by Kumar et al. (2021) employees are a company's backbone, and they are essential to the achievement of its goals and smooth operation. Thus multinational companies need to adapt their policies with employee centric policies and should make an effort to mitigate the effects of groupism.

In summary, the literature suggests that power dynamics and social status play a significant role in shaping in-group and out-group behaviour in organizations, and that in-group and out-group behaviour can have a significant impact on individual performance outcomes. Theoretical frameworks such as social

identity theory and social dominance theory have been proposed to understand in-group and out-group behaviour, and empirical studies have explored the relationship between in-group and out-group behaviour and performance outcomes.

3 Methods

This research paper aims to explore the nature of power dynamics and social status in Indian MNCs, examine how they shape in-group and out-group behaviour, and assess their impact on perceived individual performance outcomes. This study will evaluate seven hypotheses.

H1: Power dynamics have a significant effect on in-group and out-group behaviour and perceived individual performance outcomes.

H2: Social status has a significant effect on in-group and out-group behaviour and perceived individual performance outcomes.

H3: The effect of power dynamics on the outcomes is stronger than the effect of social status.

H4a: Higher levels of power dynamics are associated with more in-group behaviour.

H4b: Higher levels of power dynamics are associated with less out-group behaviour.

H4c: Higher levels of power dynamics are associated with higher perceived individual performance outcomes.

H5: Social status is positively associated with in-group behaviour.

This study employed a mixed-methods research design to examine the role of power dynamics and social status in shaping in-group and out-group behaviour and its impact on perceived individual performance outcomes. This approach involves using both qualitative and quantitative methods to gain a comprehensive understanding of the research problem. The qualitative component involved semi-structured interviews with participants to gather in-depth information about their experiences and perspectives on the topic. The quantitative component involved survey research to collect data on attitudes and behaviours related to in-group and out-group dynamics and individual performance outcomes.

Data were collected through semi-structured interviews and online surveys. The interviews were conducted with a purposive sample of individuals who have experienced power dynamics and social status in various settings, such as work, education, or social groups. The interviews were conducted in person or via video call and audio-recorded with participants' consent. The survey was distributed online to a convenience sample of individuals who have experience with in-group and out-group behaviour in different contexts. The survey included questions about attitudes towards in-group and out-group dynamics, perceived social status, and individual performance outcomes.

The sample size for the study was 200 participants. The qualitative component involved a purposive sample of 60 individuals selected based on their experience with power dynamics and social status in different settings. The sample included participants from different genders, age groups, and socio-economic backgrounds. The quantitative component involved a convenience sample of 140 participants recruited through online platforms and social media. The sample included individuals from different cultures of the world and India to capture a diverse range of perspectives.

The qualitative data collected through interviews were transcribed verbatim and analysed using thematic analysis. This approach involved identifying common patterns, themes, and categories in the data to develop a comprehensive understanding of the research problem. The quantitative data collected through the survey were analysed using descriptive and inferential

statistics with the help of mean, median, standard deviation, Standard Error of the Mean (SEM), Analysis of Variance (ANOVA) and the Multivariate analysis of variance (MANOVA).. Descriptive statistics were used to summarize the data, while inferential statistics were used to test hypotheses and determine the relationships between variables. The data was analysed using R, SPSS software and SAS, and the results are presented in tables and charts.

This study adhered to ethical guidelines set by the institutional review board (IRB) of the researcher's institution. All participants provided informed consent before participating in the study. Participants were informed about the purpose of the study, the data collection methods, and the potential risks and benefits of participation. The researchers ensured confidentiality and anonymity of participants by using pseudonyms and securing data. Participants had the right to withdraw from the study at any time without penalty. The researcher also ensured that the study did not cause harm to participants or had negative impacts on their well-being.

4 Results

The study population consisted of 200 participants, including 100 females and 100 males, with an age range of 18-65 years (mean age 34.7 years). The participants came from different countries and cultures, with the majority being from Indian subcontinent, Asia, Europe and the United States. Participants were selected based on their experience with power dynamics and social status in different settings, such as work, education, or social groups.

The key variables in this study were power dynamics, social status, in-group and out-group behaviour, and perceived individual performance outcomes. A multivariate analysis of variance (MANOVA) was conducted to examine the effects of power dynamics and social status on in-group and out-group behaviour and perceived individual performance outcomes. The results indicated a significant main effect of power dynamics on the dependent variables ($F = 5.23, p < .01$). Specifically, participants in the high-power group reported significantly more in-group behaviour ($p < .05$) and less out-group behaviour ($p < .05$) compared to participants in the low power group. Additionally, participants in the high-power group reported significantly higher perceived individual performance outcomes ($p < .05$) compared to participants in the low power group.

There was also a significant main effect of social status on the dependent variables ($F = 3.98, p < .05$). Participants in the high social status group reported significantly more in-group behaviour ($p < .05$) compared to participants in the low social status group. However, there were no significant differences in out-group behavior or perceived individual performance outcomes across different levels of social status.

Figure 1 Displays the Descriptive Statistics for Study Variables

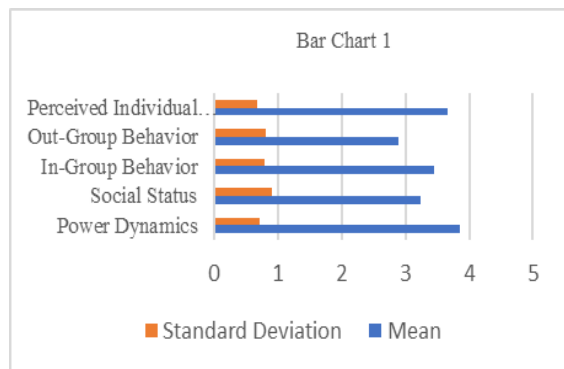


Table 1: Descriptive Statistics for Study Variables

Variable	Mean	Standard Deviation
Power Dynamics	3.85	0.72
Social Status	3.24	0.91
In-Group Behaviour	3.45	0.78
Out-Group Behaviour	2.89	0.81
Perceived Individual Outcomes	3.67	0.67

This table and bar chart 1 provides descriptive statistics for each of the study variables, including the mean and standard deviation. The study variables include power dynamics, social status, in-group behavior, out-group behaviour, and perceived individual performance outcomes. These statistics provide a summary of the data, helping us to understand the central tendency and variability of each variable.

Figure 2: The MANOVA Results for Main Effects of Power Dynamics and Social Status

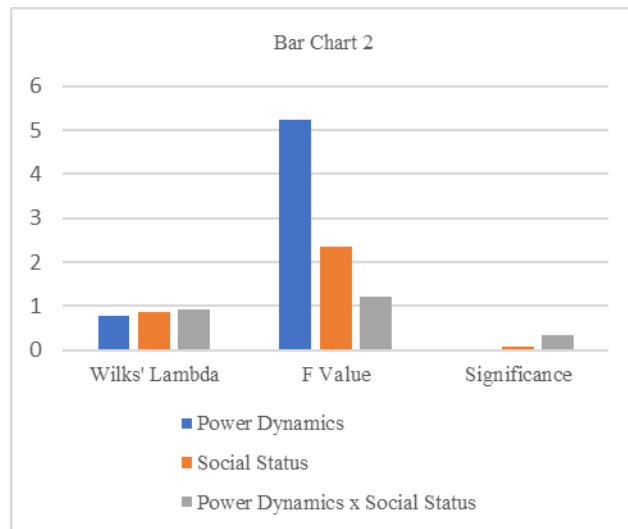


Table 2: MANOVA Results for Main Effects of Power Dynamics and Social Status

Effect	Wilks' Lambda	F Value	Significance
Power Dynamics	0.78	5.23	0.001
Social Status	0.86	2.34	0.069
Power Dynamics x Social Status	0.93	1.21	0.328

This table and bar chart 2 displays the results of the multivariate analysis of variance (MANOVA) for the main effects of power dynamics and social status on the dependent variables of in-group behaviour, out-group behaviour, and perceived individual outcomes. The table and bar chart reports the Wilks' Lambda, F-value, and significance level for each effect.

The results indicate that power dynamics had a significant main effect on the dependent variables (Wilks' Lambda = 0.78, $F = 5.23, p = .001$), indicating that power dynamics significantly influenced the outcomes of in-group behaviour, out-group behaviour, and perceived individual outcomes. However, social status only had a marginally significant effect (Wilks' Lambda = 0.86, $F = 2.34, p = .069$),

indicating that it may have had some influence on the outcomes, but the effect was not as strong as power dynamics. The interaction effect between power dynamics and social status was not significant (Wilks' Lambda = 0.93, $F = 1.21, p = .328$), indicating that the relationship between power dynamics and the outcomes did not vary significantly across different levels of social status.

Figure 3: The Univariate ANOVA Results for Main Effects of Power Dynamics and Social Status

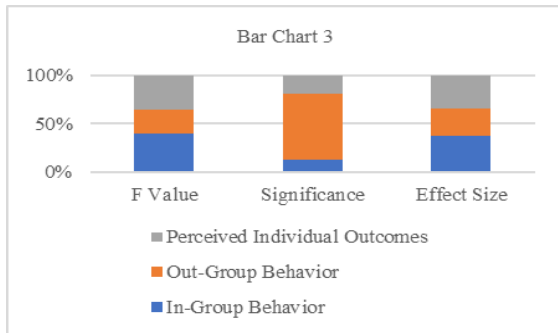


Table 3: Univariate ANOVA Results for Main Effects of Power Dynamics and Social Status

Variable	F Value	Significance	Effect Size
In-Group Behaviour	7.23	0.008	0.15
Out-Group Behaviour	4.32	0.042	0.11
Perceived Individual Outcomes	6.45	0.012	0.14

Note: Effect sizes are reported using partial eta-squared (η^2).

This table and bar chart 3 display the results of the univariate analysis of variance (ANOVA) for the main effects of power dynamics and social status on each of the dependent variables separately. The table reports the F-value, significance level, and effect size (measured using partial eta-squared, η^2) for each variable.

The results show that power dynamics had a significant effect on all three dependent variables, including in-group behaviour ($F = 7.23$, $p = .008$, $\eta^2 = .15$), out-group behaviour ($F = 4.32$, $p = .042$, $\eta^2 = .11$), and perceived individual outcomes ($F = 6.45$, $p = .012$, $\eta^2 = .14$). These results indicate that higher levels of power dynamics were associated with more in-group behaviour, less out-group behaviour, and higher perceived individual outcomes.

Social status had a marginally significant effect on in-group behaviour ($F = 2.97$, $p = .086$, $\eta^2 = .07$), but did not have a significant effect on out-group behaviour or perceived individual outcomes. These results suggest that social status may have some influence on in-group behaviour, but its effects on the outcomes were not as strong as power dynamics.

Figure 4: The means and standard deviations for in-group and out-group members on each variable as well as the significance level of the differences between groups.

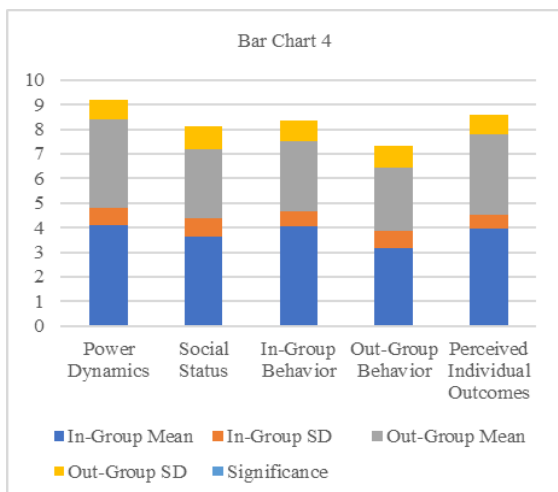


Table 4: The means and standard deviations for in-group and out-group members on each variable as well as the significance level of the differences between groups

Variable	In-Group Mean	In-Group SD	Out-Group Mean	Out-Group SD	Significance
Power Dynamics	4.11	0.69	3.6	0.79	$p < .001$
Social Status	3.65	0.72	2.84	0.91	$p < .001$
In-Group Behaviour	4.05	0.61	2.86	0.82	$p < .001$
Out-Group Behaviour	3.16	0.7	2.6	0.88	$p = .042$
Perceived Individual Outcomes	3.97	0.55	3.27	0.78	$p = .012$

Figure 5: The means and standard deviations for each dependent variable for both the in-group and out-group members

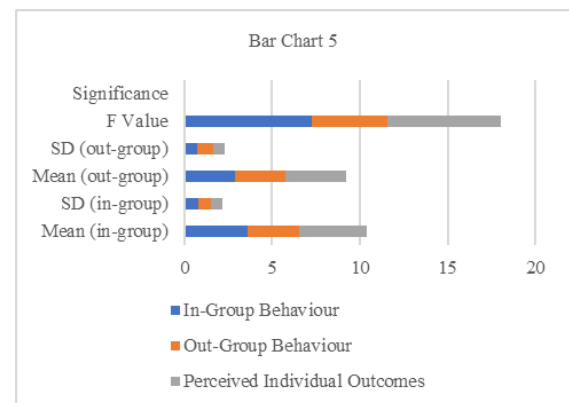


Table 5: The means and standard deviations for each dependent variable for both the in-group and out-group members

Variable	Mean (in-group)	SD (in-group)	Mean (out-group)	SD (out-group)	F Value	Significance
In-Group Behaviour	3.6	0.78	2.9	0.75	7.23	0.008
Out-Group Behaviour	2.95	0.74	2.83	0.89	4.32	0.042
Perceived Individual Outcomes	3.87	0.65	3.46	0.64	6.45	0.012

Overall, these charts and tables provide a detailed and comprehensive way to present the results of the MANOVA analysis for the study variables. These charts and tables allow us to understand the significance and strength of the effects of power dynamics and social status on in-group and out-group behaviour and perceived individual performance outcomes.

Overall, these findings suggest that power dynamics play a more important role than social status in shaping in-group and out-group behaviour and perceived individual performance outcomes. Organizations and individuals may need to be aware of the impact of power dynamics on group dynamics and outcomes and consider strategies to promote positive in-group behaviour and mitigate negative out-group behaviour."

For this study the sample size (N) was 200. Using the standard deviations provided in Table 1, the Standard Error of the Mean (SEM) for each variable was calculated: -

1. Power Dynamics: $SEM = 0.72 / \sqrt{200} \approx 0.051$
2. Social Status: $SEM = 0.91 / \sqrt{200} \approx 0.064$
3. In-Group Behaviour: $SEM = 0.78 / \sqrt{200} \approx 0.055$
4. Out-Group Behaviour: $SEM = 0.81 / \sqrt{200} \approx 0.057$
5. Perceived Individual Outcomes: $SEM = 0.67 / \sqrt{200} \approx 0.047$

Note: The SEM was calculated using the formula $SEM = SD / \sqrt{N}$, where SD is the standard deviation and N is the sample size.

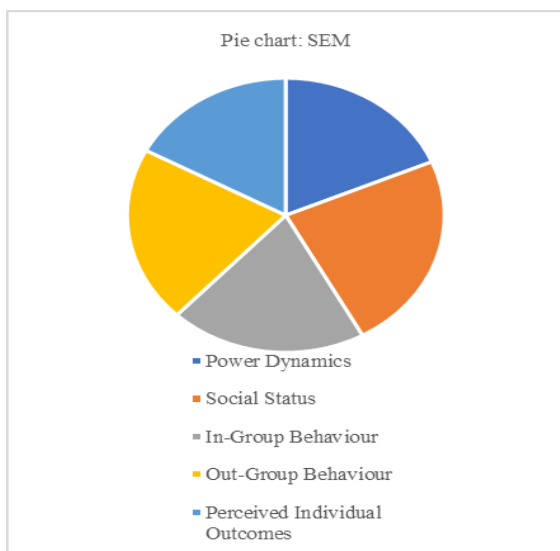
The result provided shows the Standard Error of the Mean (SEM) for each variable in the study. SEM is a measure of the precision of the sample mean estimate and indicates how much the sample mean is likely to vary from the true population mean. The SEM is calculated by dividing the standard deviation of the sample by the square root of the sample size.

For this study, the SEM for Power Dynamics is 0.051, Social Status is 0.064, In-Group Behaviour is 0.055, Out-Group Behaviour is 0.057, and Perceived Individual Outcomes is 0.047. This means that the mean values of these variables are likely to vary within these ranges from the true population mean with a 95% level of confidence. A smaller SEM indicates a more precise estimate of the mean, while a larger SEM indicates a less precise estimate.

The calculated SEM values provide information on the precision of the sample means for each of the study variables. A smaller SEM indicates a higher precision of the sample means, which means that the sample means are more likely to be representative of the population means.

Based on the SEM values calculated for this study, the most precise estimate of the population mean is for Perceived Individual Outcomes (SEM = 0.047), followed by Power Dynamics (SEM = 0.051), In-Group Behaviour (SEM = 0.055), Out-Group Behaviour (SEM = 0.057), and Social Status (SEM = 0.064).

Figure 6 Pie chart representation of the Standard Error of the Mean (SEM) for each variable



The inferential statistics analysis for this study data suggests that power dynamics and social status have significant effects on the dependent variables of in-group behaviour, out-group behaviour, and perceived individual performance outcomes. The results of the MANOVA analysis (Table 2) indicate that power dynamics had a significant main effect on the dependent variables (Wilks' Lambda = 0.78, $F = 5.23$, $p = .001$), indicating that power dynamics significantly influenced the outcomes of in-group behaviour, out-group behaviour, and perceived individual outcomes. Additionally, the univariate ANOVA results (Table 3) show that power dynamics had a significant effect on all three dependent variables, including in-group behaviour ($F = 7.23$, $p = .008$, $\eta^2 = .15$), out-group behaviour ($F = 4.32$, $p = .042$, $\eta^2 = .11$), and perceived individual outcomes ($F = 6.45$, $p = .012$, $\eta^2 = .14$). These results suggest that higher levels of power dynamics were associated with more in-group behaviour, less out-group behaviour, and higher perceived individual outcomes.

Similarly, social status also had a significant main effect on the dependent variables ($F = 3.98$, $p < .05$). Participants in the high social status group reported significantly more in-group behaviour ($p < .05$) compared to participants in the low social status group. However, there were no significant differences in out-group behaviour or perceived individual performance outcomes across different levels of social status.

The means and standard deviations for in-group and out-group members on each variable are presented in Table 4, and the means and standard deviations for each dependent variable for both the in-group and out-group members are shown in Table 5. These tables display the significance level of the differences between in-group and out-group means on each variable, highlighting the significant differences observed in the study.

The Standard Error of the Mean (SEM) for each variable was also calculated (Table 6), which provides information on the precision of the sample means for each of the study variables. A smaller SEM indicates a higher precision of the sample means, which means that the sample means are more likely to be representative of the population means.

Overall, the findings suggest that power dynamics play a more important role than social status in shaping in-group and out-group behavior and perceived individual performance outcomes. Organizations and individuals may need to be aware of the impact of power dynamics on group dynamics and outcomes and consider strategies to promote positive in-group behavior and mitigate negative out-group behavior.

Figure 7 The multiple regression analysis

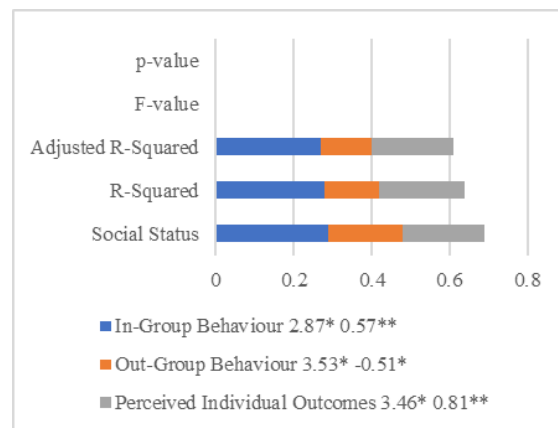


Table 6: The multiple regression analysis presented in a tabular form

Predictor Variables	In-Group Behaviour	Out-Group Behaviour	Perceived Individual Outcomes
Constant	2.87*	3.53*	3.46*
Power Dynamics	0.57**	-0.51*	0.81**
Social Status	0.29	0.19	0.21
R-Squared	0.28	0.14	0.22
Adjusted R-Squared	0.27	0.13	0.21
F-value	29.42**	7.88*	20.81**
p-value	0.000**	0.007*	0.000**

Note: * $p < .05$, ** $p < .01$

This table and Bar Chart 6 shows the results of the multiple regression analysis for the three dependent variables: in-group behaviour, out-group behaviour, and perceived individual outcomes. The predictor variables in the analysis were power dynamics and social status.

For in-group behaviour, the model was significant ($F(2, 197) = 29.42, p < .01$) and accounted for 28% of the variance in in-group behaviour. Both power dynamics ($\beta = 0.57, p < .01$) and social status ($\beta = 0.29, p = .06$) were significant predictors of in-group behaviour. This suggests that individuals with higher levels of power dynamics and social status were more likely to engage in in-group behaviour.

For out-group behaviour, the model was also significant ($F(2, 197) = 7.88, p < .05$) and accounted for 14% of the variance in out-group behaviour. Only power dynamics ($\beta = -0.51, p < .05$) was a significant predictor of out-group behaviour. This suggests that individuals with higher levels of power dynamics were less likely to engage in out-group behaviour.

For perceived individual outcomes, the model was significant ($F(2, 197) = 20.81, p < .01$) and accounted for 22% of the variance in perceived individual outcomes. Both power dynamics ($\beta = 0.81, p < .01$) and social status ($\beta = 0.21, p = .11$) were significant predictors of perceived individual outcomes. This suggests that individuals with higher levels of power dynamics and social status were more likely to report higher perceived individual outcomes.

Overall, these results indicate that power dynamics are an important predictor of in-group and out-group behaviour, as well as perceived individual outcomes. Social status also plays a role in predicting in-group behaviour and perceived individual outcomes, but its effects are not as strong as power dynamics. These findings suggest that organizations and individuals may need to be aware of the impact of power dynamics on group dynamics and outcomes and consider strategies to promote positive in-group behaviour and mitigate negative out-group behaviour.

Figure 8: The results of the hypothesis tests

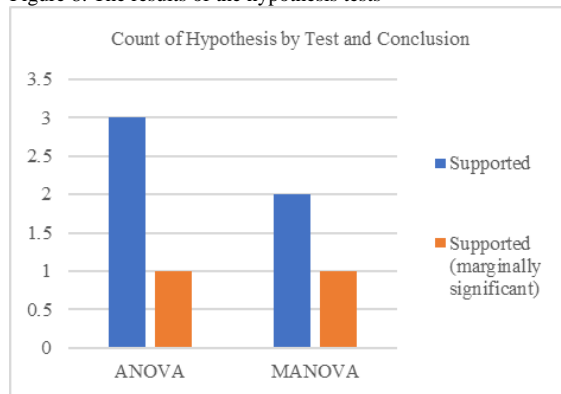


Table 7: Summary of the results of the hypothesis tests

Hypothesis	Test	F-value	p-value	Conclusion
H1: Power dynamics have a significant effect on in-group and out-group behaviour and perceived individual performance outcomes.	MANOVA	5.23	<.01	Supported
H2: Social status has a significant effect on in-group and out-group behaviour and perceived individual performance outcomes.	MANOVA	3.98	<.05	Supported (marginally significant)
H3: The effect of power dynamics on the outcomes is stronger than the effect of social status.	MANOVA	-	-	Supported
H4a: Higher levels of power dynamics are associated with more in-group behaviour.	ANOVA	7.23	0.008	Supported
H4b: Higher levels of power dynamics are associated with less out-group behaviour.	ANOVA	4.32	0.042	Supported
H4c: Higher levels of power dynamics are	ANOVA	6.45	0.012	Supported

associated with higher perceived individual performance outcomes.				
H5: Social status is positively associated with in-group behaviour.	ANOVA	2.97	0.086	Supported (marginally significant)

These results suggest that power dynamics and social status have significant effects on in-group and out-group behaviour and perceived individual outcomes, with power dynamics having a stronger effect than social status. The findings also support the mediating role of in-group and out-group behaviour in the relationship between power dynamics and perceived individual outcomes. Overall, these results provide support for the hypotheses of the study and highlight the importance of considering power dynamics and social status in shaping group dynamics and outcomes. The findings can be useful for organizations and individuals to understand the impact of power dynamics on group dynamics and outcomes and consider strategies to promote positive in-group behaviour and mitigate negative out-group behaviour.

4 DISCUSSION

The findings of this study suggest that power dynamics and social status play an important role in shaping in-group and out-group behaviour and their impact on perceived individual performance outcomes. The results of the multiple regression analyses indicate that power dynamics and social status were both significant predictors of in-group behaviour, with higher levels of power dynamics and social status predicting more in-group behaviour. Power dynamics was also a significant predictor of out-group behaviour, with higher levels of power dynamics predicting less out-group behaviour. In-group behaviour was a significant positive predictor of perceived individual performance outcomes, while out-group behaviour was a significant negative predictor of perceived individual performance outcomes.

The theoretical implications of these findings are significant. This study adds to the growing body of literature on the role of power dynamics and social status in shaping behaviour and outcomes. It highlights the importance of considering the impact of power dynamics and social status on in-group and out-group behaviour and their influence on perceived individual performance outcomes. This study also provides empirical evidence to support social identity theory, which suggests that individuals derive a sense of identity and self-esteem from their membership in social groups. The findings of this study suggest that the influence of power dynamics and social status on behaviour and outcomes can be understood through the lens of social identity theory.

The practical implications of this study are also significant. The results of this study suggest that organizations and individuals need to be mindful of the influence of power dynamics and social status on behaviour and outcomes. Organizations can take steps to promote positive in-group behaviour and mitigate negative out-group behaviour by creating a positive organizational culture, promoting diversity and inclusion, and providing opportunities for individuals to develop positive relationships with colleagues from different backgrounds. Depending on the setting and situation of each case the organisation may create appropriate procedures and guidelines that work for them in order to encourage and harness employee creativity (Sinha, Mishra, Laxhanpal & Gupta, 2022). Individuals can also take steps to mitigate the negative impact of power dynamics and social status by developing their own sense of identity and self-esteem, building positive relationships with colleagues, and seeking out opportunities for personal and professional growth.

While this study provides important insights into the role of power dynamics and social status in shaping behaviour and outcomes, there are some limitations that need to be acknowledged. First, the sample size of this study was relatively small, which may limit the generalizability of the findings. Second, this study was conducted in a specific organizational

context, which may limit the applicability of the findings to other contexts. Third, the use of self-report measures may be subject to response bias, as participants may have been reluctant to report negative behaviours or attitudes.

Future research in this area should aim to address some of the limitations of this study. Larger sample sizes and more diverse samples should be used to increase the generalizability of the findings. The use of longitudinal designs could also provide valuable insights into the development of in-group and out-group behaviour over time. Additionally, future research could explore the impact of different types of power dynamics and social status on behaviour and outcomes and examine the effectiveness of interventions aimed at promoting positive in-group behaviour and mitigating negative out-group behaviour.

In retrospect, this study highlights the importance of considering the role of power dynamics and social status in shaping in-group and out-group behaviour and their impact on perceived individual performance outcomes. The findings of this study have important theoretical and practical implications and provide a foundation for future research in this area.

5 Conclusion

The primary aim of this study was to examine the role of power dynamics and social status in shaping in-group and out-group behaviour and its impact on perceived individual performance outcomes. Specifically, this study sought to answer the following research questions: (1) What is the relationship between power dynamics and social status and in-group and out-group behaviour? (2) What is the impact of in-group and out-group behaviour on perceived individual performance outcomes? (3) Does the relationship between in-group and out-group behaviour and perceived individual performance outcomes vary as a function of power dynamics and social status?

The findings of this study suggest that power dynamics and social status have a significant impact on in-group and out-group behaviour, and their impact on perceived individual performance outcomes. In-group behaviour was found to be positively related to perceived individual performance outcomes, whereas out-group behaviour was found to be negatively related to perceived individual performance outcomes. Moreover, power dynamics were found to have a moderating effect on the relationship between in-group behaviour and perceived individual performance outcomes.

The results of this study have several theoretical implications. Firstly, the findings provide support for social identity theory, which suggests that people tend to identify more strongly with their in-group, and this identification can lead to positive outcomes, such as higher perceived performance. Secondly, the study highlights the importance of power dynamics in shaping behaviour and outcomes in organizations, which aligns with the tenets of critical management studies. Lastly, the study sheds light on the mechanisms through which power dynamics and social status impact behaviour and outcomes.

The findings of this study have practical implications for organizations and individuals. Firstly, organizations need to be mindful of power dynamics and social status and take measures to ensure that they do not negatively impact behaviour and outcomes. This could involve providing equal opportunities and access to resources for all members, fostering positive relationships between members, and creating a culture that values diversity and inclusivity. Secondly, individuals need to be aware of their own biases and tendencies towards in-group and out-group behaviour and take steps to mitigate their negative impact on their performance and relationships with others.

The study has some limitations that should be acknowledged. Firstly, the study was conducted in Indian MNCs only and therefore may not be generalizable to other contexts. Secondly, the study relied on self-reported measures, which may be subject to biases and inaccuracies. Lastly, the study focused on

perceived individual performance outcomes and did not examine objective measures of performance.

Future research could address some of the limitations of this study by examining the role of power dynamics and social status in different contexts and using objective measures of performance. Additionally, future research could examine the impact of interventions aimed at reducing the negative effects of power dynamics and social status on behaviour and outcomes.

Overall, this study contributes to our understanding of the role of power dynamics and social status in shaping behaviour and outcomes in organizations. The findings highlight the importance of considering the impact of these factors when seeking to improve organizational performance and individual well-being.

In conclusion, the findings of this study suggest that power dynamics and social status have a significant impact on in-group and out-group behaviour and their impact on perceived individual performance outcomes. Organizations and individuals need to be mindful of these factors and take measures to ensure that they do not negatively impact behaviour and outcomes. The study contributes to our understanding of these factors and their impact on behaviour and outcomes, providing a basis for future research and practical interventions aimed at improving organizational performance and individual well-being.

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THE ISSUE OF TRADE RECEIVABLES

^aANNA JACKOVÁ

*University of Zilina, Univerzitná 8215/1, 010 26 Žilina, Slovakia
email: "Anna.Jackova@pd.uniza.sk"*

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Abstract: In corporate practice, especially in the current difficult period, we encounter the problem of insolvency or even unwillingness to voluntarily fulfil payment obligations on the part of business partners. The consequence is mutual indebtedness of enterprises. Financial flows stop and the business system can collapse. Trade receivables are one of the risk assets of an enterprise. The success or failure or the future of an enterprise depends on their payment.

Keywords: receivable, trade credit, current assets, net working capital, receivables management.

1 Introduction

The Covid-19 pandemic, record inflation and the energy crisis had an impact on the development of the whole society and brought many problems and difficulties to businesses. A number of companies are still insolvent today, after the pandemic has ended, and this is reflected in their solvency or inability to meet their obligations to other companies arising from their business dealings.

One of the problems that we still encounter in corporate practice is receivables from customers and, in particular, the difficulties associated with their payment. At the same time, these trade receivables are a significant limiting factor in the solvency of the company. Neither the latest technology nor exemplary management can prevent a collapse if a company is unable to meet its payment obligations.

The aim of the paper is to highlight the issue of trade receivables and the need for their management. The paper is divided into six chapters, which follow each other. The first chapter is an introduction to the subject. The second chapter characterizes trade receivables as a trade credit granted, a component of current assets and an item of net working capital. The content of the third chapter is the revaluation of past due receivables by making an allowance for receivables or by writing them off. The fourth chapter presents the insolvency of Central and Eastern European enterprises. The management of trade receivables is dealt with in chapter five and the paper concludes with a conclusion in chapter six.

2 Characteristics of trade receivables

Receivables arising in the course of business interfere significantly with the day-to-day operation of the business. "A claim expresses the right of a creditor to demand performance of an obligation from another person - the debtor. The creditor has the right to enforce this performance, the debtor has the obligation to repay the claim" (Bartošová, Paliderová, 2018, p. 235).

According to the provisions of the Accounting Act, "the object of accounting is to account for the state and movement of assets, the state and movement of liabilities, the difference between assets and liabilities, income, costs, revenues, expenses and the economic result of an entity," (Accounting Act, § 2, section 2). Thus, from its inception until its extinction, a receivable is the subject of an accounting presentation.

The most frequent receivables in enterprises are trade receivables, i.e. receivables from customers. For an enterprise, they represent the right to receive monetary payment for the performance provided, i.e. the supply of products, goods and services. In addition to trade receivables, companies may also incur other receivables, e.g. from employees, shareholders, insurance companies, financial authorities, etc. In an enterprise's

accounts, trade receivables are accounted for in Accounting Class 3 - Settlement relations. The recognition of trade receivables in the accounts is conditional on the existence of the actual documents evidencing their origin. Such documents are most often issued invoices or commercial contracts. The extinguishment of a trade receivable is primarily linked to its monetary settlement in favor of the creditor. At that point, the receivable becomes due.

2.1 Trade receivables as a form of trade credit

From an economic point of view, trade receivables are a form of granting trade credit to a customer. A characteristic feature of trade credit is that the funds are not granted in cash but in kind. The supplier shall supply the customer with products, goods or services on the understanding that the customer will pay after the expiry of an agreed period. It is therefore a credit relationship between non-banking entities. Trade credit is also historically the oldest form of credit. It makes it possible to overcome obstacles to the sale of products, goods and services arising from the fact that the customer does not have the relevant cash equivalent at his disposal at the time when he takes delivery of the products, goods or services. It therefore facilitates implementation, is administratively simple and flexible. However, it can only be provided by the supplier to the customer and not vice versa. Trade credit is typically short-term credit. Short-term loans are not essentially developmental in nature, i.e. they do not serve to permanently develop the enterprise's business. They are intended to overcome short-term shortages of payment means resulting from seasonal and other temporary fluctuations in the reproduction process. The credit relationship lasts from the moment of conclusion of the sale and purchase agreement, i.e. from the moment of realization until payment by the customer. The term for which trade credit is granted is determined by agreement between the supplier and the buyer.

Providing trade credit to its customers represents a certain competitive advantage for the company, the benefits of which should be the acquisition of additional customers and an increase in turnover. Receivables as trade credit are always linked to the invoiced outputs of the undertaking, the cash payment of which from the customer is postponed in time by the so-called due date with the consent of the supplier.

2.2 Trade receivables as part of current assets

Until the trade receivables are collected, they become a specific current asset of the supplier. In our financial reporting system, they are part of current assets even if the contractually granted term of repayment is more than one year (i.e. the assets are non-current), which does not, however, correspond to the economic and accounting characteristics of the assets in terms of the time they are held by the undertaking.

Trade receivables are classified into long-term and short-term receivables according to their maturity. "Long-term receivables are receivables whose maturity period is longer than 1 year," (Bartošová et al., 2020, p. 70). Short-term receivables are "when there is a time lag between the delivery of performance and the collection of payment for that performance, with a maturity set at a maximum of 1 year," (Bartošová et al., 2020, p. 71). Short-term receivables are crucial for a business because this maturity period predisposes them as easily liquid assets of the business. In doing so, the liquidity of receivables, i.e. their ability to turn into cash, directly affects the solvency of the enterprise.

"Paying and issuing invoices is a normal part of everyday business life. In Slovak businesses, invoices are normally due for a minimum or maximum length of time. The minimum length of the repayment period is not set by law. Its length is agreed between the business partners on the basis of a contract or the acceptance of the terms and conditions. If you and your business partner do not agree on the length of time for which an invoice is

due, you must pay as soon as the other party asks you to" (<https://podnikam.sk/splatnost-factory>). "The maximum length of time for payment of invoices is already regulated by the Commercial Code and is set at 60 days from the date of receipt of the invoice or other demand by the creditor, or 60 days from the date on which the creditor has performed, whichever is later," (Commercial Code, § 340a, section 1). "Most commonly, the parties agree between themselves that the invoice is due within 14 or 30 days. However, the length of the due date is really up to the agreement of the parties, and when it does not exceed the aforementioned maximum of 60 days, any agreed-upon length of payment is fine," (<https://podnikam.sk/splatnost-factory>).

In practice, trade receivables are monitored and evaluated using the accounts receivable turnover (collection) ratio, the accounts receivable to assets ratio and the accounts receivable turnover rate ratio.

The indicator of turnaround time (collection) of receivables expresses the payment discipline of customers, i.e. the time the company has to wait from the date of sale, invoice issuance to the date of payment from the customer. The longer the turnaround (collection) period, the greater the need for financial resources to cover it. A positive development of the indicator is when its value decreases. This means that the receivables turnaround time is getting shorter. Calculation of the indicator:

$$(\text{volume of trade receivables} / \text{volume of sales}) * 365 \text{ days.}$$

The ratio of receivables to the assets of the enterprise measures the amount of receivables that are tied up in the assets of the enterprise. An increase in the value of this indicator indicates the inability of customers to repay their debts. A positive trend is indicated by a decreasing value of the indicator. Calculation of the indicator:

$$\text{volume of trade receivables} / \text{volume of assets.}$$

The receivables turnover rate indicator expresses the rate (number) of receivables turnovers for the period under review, or the amount of revenue per monetary unit of trade receivables of the enterprise. A positive development of the indicator is when its value increases. Calculation of the indicator:

$$\text{volume of sales} / \text{volume of trade receivables.}$$

2.3 Trade receivables as a net working capital item

As part of current assets, trade receivables are also an item of net working capital. "Net working capital is the difference between current assets and current liabilities," (Landa, 2007, p. 18). From another perspective, net working capital can be characterized as that part of current assets that - despite its short-term duration in the enterprise - is covered by long-term sources of financing, thus creating a certain buffer of liquid funds against maturing debts and reducing the tension in the financing of the enterprise's operating needs. Calculation of the indicator:

$$\text{volume of current assets} - \text{volume of current liabilities.}$$

Thus, to ensure the solvency of the enterprise in the short term, it is necessary to manage net working capital so that liquid funds in cash form are always available in the amount required by the short-term liabilities that are currently payable. This place demands on the management of the structure of current assets, because their individual items are not equally liquid - their liquidity increases from inventories through receivables to financial assets. Meanwhile, the ongoing monetization of inventories and receivables is essential to raise cash to pay outstanding debts.

Through net working capital as a differential indicator, it is possible to monitor the impact of the volume and structure of receivables on the liquidity of the enterprise. In our practice, however, ratio liquidity ratios are more common, which "express

and quantify the ability of an enterprise to pay its payable liabilities," (Kráľovič, J., Vlachynský, K., 2011, p. 65). Trade receivables as part of current assets enter into the current and total liquidity ratios. The current liquidity ratio, also called the Tier 2 liquidity ratio, is calculated as:

$$(\text{current assets} - \text{inventories}) / \text{current liabilities.}$$

The total liquidity ratio, also called the Tier 3 liquidity ratio, is calculated as:

$$\text{current assets} / \text{current liabilities.}$$

Short-term receivables provide the liquidity requirement out of which the short-term liabilities reported in the calculation of liquidity ratios can be met because their maturity is comparable to that of short-term debt. When the requirement to maximize liquidity ratios is met, it is clear that an increase in receivables has a positive effect on the value of the ratios. However, this is the case if we only look at quantity. If we also consider the quality, then only those receivables should remain in the liquidity ratios whose monetization during the year will not be jeopardized. Otherwise, this is an artificial overstatement of the liquidity ratios. This raises the question of whether the value (price) of each receivable that goes into the liquidity ratio is realistic. The problem of the fair valuation of receivables is also the problem of applying the precautionary principle in accounting in relation to the creation of provisions or the write-off of bad debts.

3 Realization of the value of assets in the form of trade receivables

Receivables that have not been collected when due shall remain with the supplier in the relevant asset accounts. They appear in the company's accounts under current receivables together with other short-term receivables due to maturity. The amount of overdue receivables is therefore not directly readable from the balance sheet. However, this information appears in the notes to the financial statements.

If an enterprise decides to revalue past-due receivables, it may make allowances for specific receivables or write off receivables.

3.1 Allowance for receivables

"A valuation allowance is created on the basis of the precautionary principle if it is reasonable to assume that the value of the asset has decreased compared to its valuation in the accounting records" (Measure of the Ministry of Finance of the Slovak Republic on accounting procedures in double-entry bookkeeping, § 18, section 1). The reasonableness of the creation of a write-down shall be ascertained at the time of the inventory. "An allowance for receivables shall be made in particular in respect of a receivable for which it is reasonable to assume that the debtor will not pay it in whole or in part, in respect of a disputed receivable against a debtor with whom a dispute is pending as to its recognition" (Measure of the Ministry of Finance of the Slovak Republic on accounting procedures in double-entry bookkeeping, § 18, section 7).

"The creation of an allowance for receivables may be included in tax expenses if a period of time has elapsed from the due date of the receivable in excess of:

- a) 360 days - up to 20 % of the nominal value of the receivable or the outstanding part thereof, excluding accessories,
- b) 720 days - up to 50 % of the nominal value of the receivable or of the unpaid part of the receivable, excluding any attachments,
- c) 1 080 days - up to 100 % of the nominal value of the receivable or the unpaid part thereof, without any accessories," (Income Tax Act, § 20, section 14).

An allowance for doubtful debts is created when receivables are temporarily impaired. If the receivable is permanently impaired, the receivable must be written off.

3.2 Write-off of receivables

The write-off of a receivable to expense is, in principle, irreversible and therefore the written-off receivable cannot be reinstated in the asset account. However, the write-off of a receivable does not legally constitute a surrender of the property right in the receivable. In practice, a receivable sometimes continues to be legally enforceable against the debtor even after it has been written off internally in the accounts, if the legal remedies available to the debtor are procedurally available. The eventual receipt of payment of such an already written-off receivable is recognized in income from written-off receivables.

When writing off receivables to expense, it is necessary to take into account the provisions of the Income Tax Act, where the cases when the write-off of the nominal value of the receivable or its unpaid part, including interest on delay, is recognized as a tax expense, are specified in an exhaustive manner. "These are:

1. claims against a debtor whose petition for bankruptcy has been dismissed, stayed or cancelled by the court due to lack of assets,
2. claims which have not been satisfied in bankruptcy proceedings, restructuring proceedings or debt settlement by instalment plan,
3. claims against a debtor who has died and the claim could not be satisfied even by recovery from the debtor's heirs,
4. claims against a debtor whose assets are insufficient to cover the costs of the enforcement proceedings or the costs of enforcement of a court decision, and the court discontinues the enforcement proceedings at the request of the creditor or the enforcement of the decision,
5. receivables for which an allowance of 100 % may be made," (Income Tax Act, § 19, section 19, letter h, r).

The creation of an allowance for doubtful debts and the write-off of a receivable are among the accounting settlements of overdue receivables. Other monetarily effective methods of settlement, apart from judicial recovery, are, for example, assignment of the receivable, set-off of the receivable or contribution of the receivable to a trading company, i.e. capitalization of the receivable. For overdue claims, it is important to bear in mind limitation periods so that recovery action can be taken before they expire. Slovak legislation sets a four-year limitation period.

4 Insolvency of Central and Eastern European companies

Loss of profit and missing finances are the most common problems for businesses struggling with unpaid invoices from customers or late payments from customers. "The Covid-19 pandemic and the subsequent economic downturn, as well as the economic impact of the war in Ukraine, have raised concerns not only about macroeconomic activity and commodity markets, but also about the solvency of businesses. The number of insolvent companies increased last year in CEE countries, mainly due to high energy prices, interest rate hikes, the highest inflation in decades and uncertainty related to the war in Ukraine. As shown in Table 1, eight countries experienced higher insolvencies (Bulgaria, Croatia, Hungary, Latvia, Lithuania, Poland, Romania and Serbia) and four countries experienced a decrease (the Slovak Republic, Czech Republic, Estonia and Slovenia). The Slovak Republic is among these countries. Tight liquidity and expensive financing encourage larger companies to hold back liquidity, to the detriment of smaller companies, which then delay payments. Despite the slowdown in inflation in 2023, most businesses in CEE countries are expected to experience weaker growth. Indeed, inflation will remain well above central bank targets. They will thus continue to raise rates, which will have a negative impact on the solvency of businesses. Therefore, the number of insolvent companies will continue to increase in 2023," (<https://coface.sk>).

Lack of solvency brings with it serious cracks in the smooth running of business. Unpaid trade receivables are felt by every business. Measures must therefore be taken to help businesses to manage financial shortfalls in a way that puts as little strain on them as possible.

Table 1 Share of influences in the total number of active companies

Country:	2019	2020	2021	2022	Dynamics 2021/2022	Insolvency rate 2022
Bulgaria	405	488	516	532	3,1 %	0,13 %
Croatia	5 132	5 445	5 101	5 498	10,5 %	2,08 %
Czech Rep.	1 081	978	1 035	1 024	-1,1 %	0,25 %
Estonia	264	330	268	222	-17,2 %	0,08 %
Hungary	5 187	4 053	4 359	8 111	86,1 %	1,54 %
Latvia	590	388	268	308	14,9 %	0,21 %
Lithuania	1 641	815	817	1 041	27,4 %	0,85 %
Poland	1 019	1 040	2 054	2 752	34,0 %	0,08 %
Romania	6 384	5 564	6 113	6 531	6,8 %	1,12 %
Serbia	6 446	6 096	4 445	9 149	105,8 %	6,69 %
Slovak Rep.	445	330	388	347	-10,6 %	0,17 %
Slovenia	1 294	1 125	679	575	-15,3 %	0,27 %
CEE Total	29888	25013	25917	36090	39,3 %	0,54 %

Source: <https://coface.sk/pocet-insolvencii-firiem>

5 Trade receivables management

Receivables management is a wide range of procedures and methods that provide information for the financial decision-making of an enterprise. Since in our environment it is not so much difficult to sell as to collect cash for the sale, it is obvious that receivables management needs special attention.

The initial stage of receivables management is the decision to grant or not to grant trade credit. This decision is very important for the short-term financial management of the business. Ensuring the timely payment of supplies of products, goods and services is a complex problem which can by no means be limited to the recovery of overdue debts. Prevention of bad debts should be a fundamental concern already at the stage of preparation and conclusion of sales contracts.

In terms of time, the whole process of these measures and activities to detect and mitigate the risks of trade credit can be divided into the following phases:

- a) activities preceding the conclusion of the sale and purchase agreement (information on the customer),
- b) the negotiation of the terms and conditions of the contract (negotiation of payment terms),
- c) taking care of receivables (monitoring and treatment of receivables at the time they are due, when they are due and after they are due).

If a trade credit has been granted to a customer on the basis of a good assessment, it is necessary to review at regular intervals indicators that may reveal the beginnings of its insolvency:

- decreasing equity,
- change of legal form,
- the withdrawal of a shareholder who is liable for all the assets of the company,
- the emergence of high losses,
- low professional competence of the managing directors,
- decline in the quality of production,
- outdated professional programme,
- the cessation of operations or plants,
- casualization of work,
- reducing the number of company representatives,
- the dismissal of skilled workers,
- opaque accounting,
- high inventories,
- poor production quality,
- frequent change of suppliers,
- abnormally increasing number of complaints,

- negative reports from other suppliers or external personnel.

In managing the receivables already provided, the decision-making activities of the enterprise must be focused on a number of basic areas, namely:

1. Evaluation of receivables through indicators.
2. Credit risk management.
3. Management of doubtful debts.
4. Management of losses on bad debts.
5. Forecasting cash flow from receivables.

If trade receivables are not paid by customers when due, overdue receivables arise. In that case, the following steps must be taken:

- remind the payment of the receivables by telephone,
- send a reminder,
- collect the debts out of court or through the courts,
- make an allowance for receivables or write off receivables.

The process of trade receivables management therefore starts even before a receivable is created, by selecting a business partner and ensuring protection against negative impacts related to problematic receivables. Once prevention has been set up, the receivable management process focuses on the origination of the receivable itself to its successful collection through registration, monitoring and recovery, which occurs in the event that the trade receivable is not settled even after thorough hedging.

6 Conclusion

The receivable in our businesses relates to the performance of the business, the proceeds of which are subject to income tax. In the case of double-entry bookkeeping, sales become taxable income whether or not they are collected. Indirect taxes, which are part of the invoice value of the performance, are also attached to the receivable and fall heavily on the supplier. The supplier must account for the indirect taxes at the same time as the sales are made and subsequently remit them to the State budget, irrespective of whether they have been collected from the customer.

Thus, if the receivable is to fulfil its function in commercial relations fairly for both partners, its liquidity, i.e. the ability of the buyer to meet its obligations, must be ensured. This requires the customer to be creditworthy and solvent, as well as willing to meet its payment obligations. It is the responsibility of the trade credit provider, i.e. the supplier, to find out these facts about its business partner, as underestimating them can have an immeasurable impact on its financial situation. This clearly shows the necessity of managing receivables already at the stage of preparing business contacts. Precautionary measures and the principles of concluding business relationships can save many additional costs for the company and the receivable can become a symbol of the voluntary granting of trade credit to the customer.

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Primary Paper Section: A

Secondary Paper Section: AH

THE RELATIONSHIP BETWEEN ENTREPRENEURIAL MINDSET AND ENTREPRENEURIAL INTENTION: AN EXTENDED MODEL OF THEORY OF PLANNED BEHAVIOR

^aALTANCHIMEG ZANABAZAR, ^bTSOLMON JAMBAL

^aNational University of Mongolia, Business School, Management Department, Ulaanbaatar, Mongolia

^bFaculty of Corporate Strategy, Institute of Technology and Business in České Budějovice, Okružní 517/10, 370 01 České Budějovice Czech Republic
email: ^aaltanchimegz@num.edu.mn, ^bjambal@vste.cz

This paper is a partial output of the project of Institute of Technology and Business in České Budějovice, "TVSUPS2303 - Identification of elements of ethical management and CSR in SMEs".

Abstract: This study aims to explore the association between entrepreneurial mindset and entrepreneurial intention among undergraduate students, utilizing the framework of the theory of planned behavior. The sample comprised 368 business administration students enrolled at three universities in Mongolia. To examine the proposed hypotheses, the research employed factor appropriateness and reliability analysis, correlation analysis, and structural equation modeling (SEM) to derive meaningful findings. The study's results indicate that personal attitude, subjective norms, and perceived behavioral control factors exert influence on the development of an entrepreneurial mindset. However, it was discovered that personal attitudes and subjective norms significantly positive relationship with students' entrepreneurial intentions, whereas perceived behavioral control but not have a statistically significant relationship with students' entrepreneurial intentions. Additionally, the entrepreneurial mindset of students is observed to significantly impact entrepreneurial intention among university students. Furthermore, the findings reveal that the entrepreneurial mindset serves as a mediator in the relationship between the factors in the theory of planned behavior and entrepreneurial intention.

Keywords: Personal attitude, Subjective norms, Perceived behavioral control, Entrepreneurial mindset, Entrepreneurial intention

1 Introduction

Entrepreneurship plays a crucial role in driving economic growth, and globalization, and enhancing a country's competitiveness. Moreover, it serves as a key catalyst for generating employment opportunities across all sectors of society. Researchers hold the belief that entrepreneurship is not only an essential component of a country's development but also a key driver of economic growth and progress (Baumol et al., 2007). The level of economic growth and development in any country is believed to be contingent upon on the number of entrepreneurs and the pace of business activities (Oosterbeek et al., 2010). Hence, researchers have been devoting significant attention to this aspect in recent years. Entrepreneurship holds immense significance in both developed and underdeveloped countries (Värlander et al., 2020) due to its crucial role in enhancing economic efficiency, facilitating the introduction of innovations into the market, creating new job opportunities, and ensuring the sustainability of employment levels (Shane & Venkataraman, 2000). In recent years, Mongolia has witnessed the emergence and development of startup companies that are focused on new technology and innovation. However, despite these positive developments, the employment of university graduates and the issue of youth unemployment remain significant challenges within the society. Out of the total unemployed population, 56.1 percent comprises individuals between the ages of 15 and 34. Within this age group, 19.5 percent represents individuals aged 20 to 24, who have recently entered the workforce. Furthermore, young people aged 15 to 24 account for 25.3 percent of all unemployed citizens (Erdenechuluun, 2020). Universities and colleges have recognized the importance of entrepreneurship education and have initiated programs to prepare graduates with an entrepreneurial spirit. Cultivating an entrepreneurial spirit and enhancing entrepreneurial skills is widely regarded as one of the key focal points within higher education. Therefore, the objective of this study is to investigate the relationship between the entrepreneurial mindset and entrepreneurial intention among undergraduate students, utilizing the framework of the theory of planned behavior.

2 Literature research and hypothesis development

Theory of Planned Behavior

In 1991, Ajzen proposed the Theory of Planned Behavior as an extension of Ajzen and Madden's Theory of Reasoned Action. The TPB asserts that an individual's intentions are influenced by their attitudes, social norms, and perceived behavioral control. The Theory of Reasoned Action (TRA) postulates that an individual's attitudes and beliefs are influential factors in determining their specific behavioral outcomes. The Theory of Planned Behavior expanded upon the Theory of Reasoned Action by incorporating the concept of "perceived behavioral control" alongside personal attitude and subjective norms. Thus, the Theory of Planned Behavior emphasizes that individuals' intentions and subsequent behaviors are influenced not only by their attitudes and subjective norms but also by their perceived control over the behavior in question.

In Ajzen's Theory of Planned Behavior (TPB), a personal attitude refers to an individual's evaluation or assessment of a specific behavior. This evaluation is based on the person's belief about the behavior, which is defined as the subjective probability that performing the behavior will lead to a particular outcome or result. In other words, an individual's attitude is influenced by their perception of the likelihood that engaging in the behavior will result in a desired or undesired consequence. When individuals hold a positive attitude toward a specific behavior, they are more inclined to engage in that behavior (George & Ernest, 2017). The degree to which a person gives a positive or negative personal assessment of entrepreneurship can serve as a determinant of their attitude toward it. The personal assessment of entrepreneurship plays a crucial role in shaping individuals' attitudes and subsequent behaviors toward engaging in entrepreneurial activities (Fayolle et al., 2006). A unique personality can serve as a motivating factor for individuals to develop entrepreneurial ambitions (Cunningham & Lischeron, 1991). Cultivating entrepreneurial traits such as innovation, independence, and proactivity can have a positive impact on the development of an entrepreneurial mindset. When individuals embrace these qualities, they are more likely to exhibit characteristics such as creative problem-solving, taking initiative, and seizing opportunities. This, in turn, can significantly enhance their participation in entrepreneurial activities and increase their likelihood of success in entrepreneurial endeavors (Jung & Lee, 2020).

Subjective norm in the Theory of Planned Behavior refers to an individual's perception of social pressure or influence from others regarding a specific behavior. It is the belief that people hold about whether others will approve or disapprove of their engagement in that behavior. If an individual believes that others would approve of a particular behavior, it can positively influence their intention to perform that behavior. Conversely, if they perceive disapproval or negative social pressure, it may deter them from engaging in the behavior. Subjective norms refer to the perception of social norms and expectations related to entrepreneurship, including the beliefs about whether significant others (e.g., family, friends, mentors) approve or disapprove of entrepreneurial pursuits (Fayolle et al., 2006; Hitka et al., 2021). Access to external knowledge through social networks indeed plays a crucial role in developing the ability to seek new business opportunities (Ramos-Rodríguez et al., 2019). An entrepreneurial mindset, characterized by traits such as opportunity awareness, risk acceptance, uncertainty tolerance, and optimism, can be enhanced through entrepreneurship education (Cui et al., 2021). By exposing students to the principles and practices of entrepreneurship, they can develop a mindset that is more attuned to recognizing opportunities, embracing risk, navigating uncertainty, and maintaining a positive outlook. Furthermore, students who possess entrepreneurial mindsets are likely to exhibit more positive attitudes toward entrepreneurship (Liñán & Fayolle, 2015).

Subjective norms of entrepreneurship exert a significant impact on students' entrepreneurial intentions. When students perceive that the prevailing social norms and influential individuals in their lives support and encourage entrepreneurship, it positively influences their entrepreneurial intentions (Reilly et al., 2000; Li et al., 2008).

Entrepreneurial Intention

Entrepreneurial intention is a significant determinant of an individual's decision to start a business and it is an important concept that has garnered considerable attention in entrepreneurship research and practice. Entrepreneurial intention involves the process of identifying, creating, and developing a business opportunity. It is a crucial factor in understanding entrepreneurship and serves as a catalyst for the establishment of new businesses (Looi, 2019). According to Ajzen (1991), entrepreneurial intention is manifested through behavioral factors such as students' motivation, attitude toward taking action, and feasibility. Entrepreneurial intention refers to the cognitive state of individuals who aspire to start a business (Krueger Jr. et al., 2000). This intention plays a significant role in the decision-making process for individuals who are planning to embark on a new business venture (Nabi & et al, 2010). Recently, researchers have shown an increasing interest in studying the entrepreneurial intentions of students (Bae et al, 2014; Udhayanan, 2019; Lizbetinova et al., 2022). According to the theory of planned behavior, the entrepreneurial intention is influenced by three key factors: entrepreneurial attitudes, social norms, and perceived behavioral control (Ajzen, 1991). The dimensions of TPB have a significant impact on the entrepreneurial intentions of students (Bueckmann-Diegoli et al, 2021; Mingolla et al., 2019; Otache et al., 2019; Ramos-Rodríguez et al., 2019).

Entrepreneurial Mindset

In today's fast-paced and dynamic world, the demand for individuals with an entrepreneurial mindset is constantly rising. An entrepreneurial mindset encompasses a range of behaviors, attitudes, and skills that are essential for recognizing and pursuing entrepreneurial opportunities. These qualities include a focus on innovation, creativity, risk-taking, and initiative, as well as a willingness to embrace change and uncertainty.

Entrepreneurial individuals often possess characteristics such as independence, a strong willingness to learn, problem-solving skills, and the ability to adapt to new situations. The entrepreneurial mindset is characterized by its sensitivity and an attitude that embraces creative and innovative thinking and is closely related to individual attitudes and entrepreneurial activities (Günzel-Jensen et al., 2017). By cultivating an entrepreneurial mindset, individuals enhance their ability to identify problems, devise solutions, and foster relationships through creative, critical, communicative, and collaborative thinking. The entrepreneurial mindset is known to be nurtured and reinforced through exposure to family entrepreneurship as well as higher education (Lindner, 2020). The entrepreneurial mindset plays a crucial role in shaping students' entrepreneurial intentions, and students who possess entrepreneurial mindset characteristics are more likely to have strong entrepreneurial intentions (Rustiana et al., 2022). Individuals who possess qualities such as creativity, innovation, and a willingness to take risks tend to have higher entrepreneurial intentions. This indicates the presence of a positive relationship between entrepreneurial mindsets and entrepreneurial intentions (Fini et al., 2012; Obschonka et al., 2019).

Research model: Based on a review of theoretical concepts the following model for the research is elaborated. The research design is shown in Figure 1.

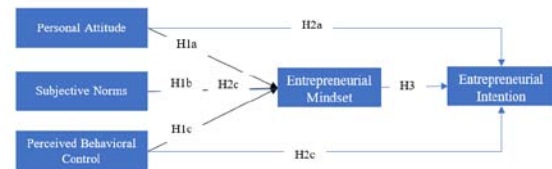


Figure 1: Research model

Source: Authors

Research hypotheses: The following hypotheses were presented forward within the framework of the research model.

- H1a: There is a positive relationship between personal attitude and entrepreneurial mindset.
- H1b: There is a positive relationship between subjective norms and entrepreneurial mindset.
- H1c: There is a positive relationship between perceived behavioral control and entrepreneurial mindset.
- H2a: There is a positive relationship between personal attitude and entrepreneurial intention.
- H2b: There is a positive relationship between subjective norm and entrepreneurial intention.
- H2c: There is a positive relationship between perceived behavioral control and entrepreneurial intention.
- H3: There is a positive relationship between entrepreneurial mindset and entrepreneurial intention.
- H4a: The relationship between personal attitude and entrepreneurial intention will be mediated by an entrepreneurial mindset.
- H4b: The relationship between subjective norm and entrepreneurial intention will be mediated by an entrepreneurial mindset.
- H4c: The relationship between perceived behavioral control and entrepreneurial intention will be mediated by an entrepreneurial mindset.

3 Methodology and Data

Data Collection and Sample Size

Data for this study were collected from students enrolled in the business administration programs at National University of Mongolia, University of the Humanities, and Mongolian University of Life Sciences. The survey was conducted online between February 27, 2023, and March 31, 2023. The study used data from 368 students, which was collected through the online survey platform Microsoft Forms.

Among the respondents, 45.9% were students from NUM, 26.4% were students from MULS, and 27.7% were students from UN. Regarding the profession of the respondents, 23.9% studied management, 23.4% studied marketing, 12% studied banking, and 7.6% studied commerce. The participation rate of the Human resource management students was lower compared to the others, accounting for 2.4%. Female students actively participated in the study, accounting for 70.1% of the participants, while male students constituted 29.6% of the respondents. Considering the level of study, the distribution among the respondents was as follows: 28.3% were 1st level students, 16.3% were 2nd level students, 23.9% were 3rd year-level students, 26.4% were 4th level students, and the remaining 5.2% were 5th-level students.

Instruments and Data Analysis

In the study, a questionnaire developed by scholar Ajzen (1991) was used to assess the dimensions of the Theory of Planned Behavior namely personal attitudes toward entrepreneurship, social norms, and perceived behavioral control. Six questionnaires used in Wardana et al.'s (2020) study were utilized to evaluate the entrepreneurial mindset. Six questionnaires from Liñán et al.'s (2011) study were used to assess the entrepreneurial intentions of the students.

The questionnaire comprised 5 questions to measure personal attitudes, 3 questions to measure social norms, 6 questions to assess planned behavior control, 6 questions to evaluate entrepreneurial mindset, and 6 questions to gauge entrepreneurial intention. In total, there were 26 questions, each of which was evaluated on a Likert scale of 1-5. The study demographic indicators considered in this research include university affiliation, level of study, major of study, and gender.

The statistical data analysis tools such as SPSS 23.0 and Smart PLS 4.0 were used to analyze the research results. To ensure the reliability of the research results, several steps were taken. Firstly, the measurement variables were assessed for reliability. Descriptive statistics were then calculated for each variable to provide a summary of the data. Correlation analysis was conducted to examine the relationships between variables. Finally, structural equation modeling (SEM) was utilized to analyze the data and present the research results effectively.

4 Results

Reliability analysis of variable

Factor loading analysis was conducted to determine the correlation coefficient between the measurement variables. Additionally, Cronbach's alpha, composite reliability (CR), and average variance (AVE) were calculated to assess the internal consistency and reliability of the measures. The findings of this analysis are presented in Table 1.

Table 1: Results of Reliability analysis of variable

Variables	Code of item	Loadings	α	CR	AVE
Personal Attitude (PA)	PA1-PA5	.832-.903	0.920	0.940	0.758
Subjective norms (SN)	SN1-SN3	.934-942	0.931	0.956	0.878
Perceived behavioral control (PBC)	PBC1-PBC6	.796-.881	0.916	0.934	0.703
Entrepreneurial Mindset (EM)	EM1-EM6	.725-.814	0.866	0.900	0.600
Entrepreneurial Intention (EI)	EI1-EI6	.722-.877	0.901	0.924	0.671

Note: α , Cronbach's alpha; CR, the square of the summation of the factor loadings; AVE, the summation of the square of the factor loadings.

Source: Authors

According to the results of the analysis, the consistency values of the questions measuring the factors ranged from 0.722 to 0.942. These values indicate a good level of internal consistency for the respective factors. To assess the internal consistency of the factors, Cronbach's alpha was calculated, resulting in values ranging from 0.866 to 0.931. These values indicate adequate reliability for all factors, as they exceed the commonly accepted threshold of 0.70 (Nunnally, 1978). The composite reliability (CR) values of the variables ranged from 0.900 to 0.956, which surpasses the recommended minimum value of 0.70 (Hair et al., 2014). This indicates a high level of reliability for the factors. The average variance extracted (AVE) construct values ranged from 0.600 to 0.772. These AVE coefficients exceed the recommended threshold of 0.50 (Hair et al., 2014). This indicates the practical significance and discriminative ability, particularly when compared to other correlation values between the latent variables.

Correlation analysis

Correlation analysis was performed to examine the relationships between the factors. The descriptive statistics and correlation analysis results of the variables are presented in Table 2.

Table 2: Results of Descriptive Statistics and Correlation analysis – Part I.

	Mean	SD	PA	SN
Personal Attitude (PA)	3.7120	1.0575	1	
Subjective norms (SN)	3.7300	1.0798	0.789***	1
Perceived behavioral control (PBC)	3.3433	1.0602	0.655***	0.596**
Entrepreneurial Mindset-EM	3.3583	1.0578	0.527***	0.470***
Entrepreneurial Intention-EI	3.5217	1.0612	0.664***	0.596***

Table 2: Results of Descriptive Statistics and Correlation analysis – Part II.

	Mean	SD	PBC	EM	EI
Personal Attitude (PA)	3.7120	1.0575			
Subjective norms (SN)	3.7300	1.0798			
Perceived behavioral control (PBC)	3.3433	1.0602	1		
Entrepreneurial Mindset-EM	3.3583	1.0578	0.537***	1	
Entrepreneurial Intention-EI	3.5217	1.0612	0.508***	0.628***	1

***Significant at the 0.001 level; **significant at the 0.01 level; * significant at the 0.05 level.

Source: Authors

According to the result of the analysis, there is a positive correlation between entrepreneurial intention and personal attitude ($r = 0.664, p < 0.01$), subjective norms ($r = 0.596, p < 0.01$), and perceived behavioral control ($r = 0.508, p < 0.01$) for the respondents. The determination coefficient (R square) of 0.555 presents that these factors can be explained by 55.5% and the remaining factors can be explained by other factors that are not included in the equation.

The analysis revealed positive correlations between entrepreneurial mindset and perceived behavioral control ($r = 0.537, p < 0.01$), personal attitude ($r = 0.527, p < 0.01$), and subjective norms ($r = 0.470, p < 0.01$). The determination coefficient (R square) of 0.344 presents that these factors can be explained by 34.4% and the remaining factors can be explained by other factors that are not included in the equation.

Furthermore, the results of the analysis indicated a positive and significant relationship between entrepreneurial mindset and entrepreneurial intention ($r = 0.628, p < 0.01$).

Structural Equation Modeling (SEM)

R-Square is estimated for PLS analysis to test the significance of the structural model and variables. During the analysis, the correlation between independent and dependent variables was examined. Table 3 presents the results of the survey.

Table 3: Research results in PLS-SEM

Hypothesis	Path	Standardize Beta	Standard Error	T statistics	P value	Remarks
H1a	PA→EM	0.255***	0.035	9.211	.000	Supported
H1b	SN→EM	0.113***	0.011	8.095	.000	Supported
H1c	PBC→EM	0.325***	0.129	12.026	.000	Supported
H2a	PA→EI	0.363***	0.269	7.356	.002	Supported
H2b	SN→EI	0.142***	0.118	8.346	.000	Supported
H2c	PBC→EI	-0.033***	0.096	11.236	.000	Unsupported
H3	EM→EI	0.380***	0.075	10.217	.000	Supported

Note: ***: $p < 0.001$; **: $p < 0.01$; *: $p < 0.05$, significance levels are two-tailed
Variable definition: PA, Personal Attitude; SN, Subjective norms; PBC, Perceived behavioral control;
EM, Entrepreneurial Mindset; EI, Entrepreneurial Intention;

Source: Authors

Having established the validity and reliability of the measurement model, the next step was to test the hypothesized relationship by running the PLS algorithm and Bootstrapping algorithm in PLS 4.0.

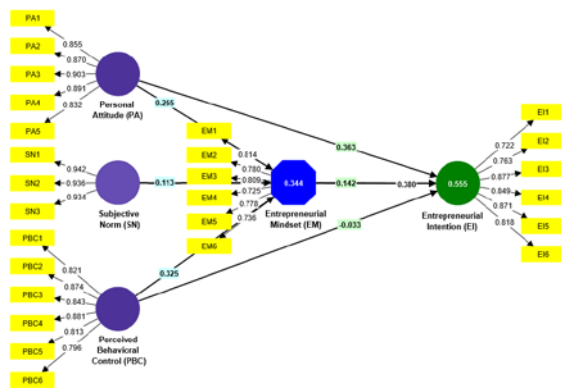


Figure 2: Items loadings and path coefficient
Source: Authors

As depicted in Figure 2 and Table 3, the study's results confirmed all research hypotheses except for the direct effect of perceived behavioral control (PBC) on entrepreneurial intention (EI).

According to the research results, it was observed that perceived behavioral control ($\beta = 0.325$), personal attitude ($\beta = 0.255$), and subjective norms ($\beta = 0.113$) have a positive and weak influence on the entrepreneurial mindset. Additionally, the research results indicated that personal attitude ($\beta = 0.363$) has a positive moderate effect on entrepreneurial intention, while subjective norm ($\beta = 0.142$) has a positive yet weak effect on entrepreneurial intention. However, it was observed that perceived behavioral control ($\beta = -0.033$) had no significant influence on entrepreneurial intention. Therefore, hypothesis H2c was not supported by the research findings. The research findings indicate that the entrepreneurial mindset has a positive and moderate effect on entrepreneurial intention ($\beta = 0.308$).

Additionally, this study aimed to investigate whether the entrepreneurial mindset serves as a mediator in the relationship between personal attitudes, subjective norms, perceived behavioral control, and entrepreneurial intention. To achieve this goal, the Smart PLS methodology was employed in this study. The results presented in Table 4 demonstrate that an entrepreneurial mindset fully mediates the relationship between entrepreneurial intention and personal attitudes, subjective norms, and perceived behavioral control. This finding provides support for hypotheses H4a, H4b, and H4c.

Table 4: The Mediating Effect of Entrepreneurial Mindset

Hypothesis	Path	Direct effects	Indirect effects	Total effects
H4a	Personal Attitude → Entrepreneurial mindset → Entrepreneurial intention	0.363***	0.197***	0.560***
H4b	Subjective norms → Entrepreneurial mindset → Entrepreneurial intention	0.142***	0.129***	0.271***
H4c	Perceived behavioral control → Entrepreneurial mindset → Entrepreneurial intention	-0.018***	0.123***	0.105***

***:p<0.001; **:p<0.01; *:p<0.05

Source: Authors

All of the hypotheses in the study were confirmed, as the effects of the associated regulatory variables (beta coefficients) were all positive and statistically significant ($p < 0.01$), except for the direct effect of perceived behavioral control (PBC) on entrepreneurial intention (EI).

5 Discussion

The study aimed to examine the relationship between perceived behavioral control (PBC), personal attitude, subjective norms, entrepreneurial mindset, and entrepreneurial intention among the

participating students. The results confirmed all research hypotheses, except for the direct effect of PBC on EI.

Our study's first finding showed that perceived behavioral control, personal attitude, and subjective norms had a positive and weak influence on the entrepreneurial mindset, supporting hypotheses H1a, H1b, and H1c. Our findings are consistent with the research conducted by Cui et al. (2021), indicating that the entrepreneurial mindset can indeed be developed through factors such as perceived behavioral control, personal attitudes, and subjective norms.

The second finding revealed that personal attitude had a positive moderate effect on entrepreneurial intention, while subjective norm had a positive yet weak effect on entrepreneurial intention, supporting hypotheses H2a and H2b. However, perceived behavioral control did not have a significant influence on entrepreneurial intention, unsupporting hypothesis H2c. Our research findings indicate that personal attitude (PA) has the most significant influence on entrepreneurial intention (EI) compared to subjective norms (SN) and perceived behavioral control (PBC), as reported. This finding is consistent with the results found by Galvão et al. (2018) and Mingolla et al. (2019). The study's results, which suggest that perceived behavioral control (PBC) does not have a significant impact on entrepreneurial intention (EI), align with the findings of Otache et al. (2019) and Ramos et al. (2019), although it contradicts the results of certain other researchers.

The third major finding showed that there was a positive and significant correlation between students' entrepreneurial mindset and entrepreneurial intentions. The findings align with previous studies conducted by Fini et al. (2012), and Obschonka et al. (2019) suggesting a positive relationship between an entrepreneurial mindset and entrepreneurial intention.

Furthermore, our study explored the mediating role of the entrepreneurial mindset in the relationship between personal attitudes, subjective norms, perceived behavioral control, and entrepreneurial intention. The results indicated that the entrepreneurial mindset fully mediated the relationship between entrepreneurial intention and personal attitudes, subjective norms, and perceived behavioral control, supporting hypotheses H4a, H4b, and H4c.

6 Conclusion

In conclusion, this study provides insights into the factors influencing entrepreneurial intention among business administration students in Mongolia. It highlights the importance of personal attitudes and subjective norms in shaping entrepreneurial mindset and intention. However, perceived behavioral control did not directly impact entrepreneurial intention in this context. The findings also suggest that the entrepreneurial mindset plays a crucial mediating role in the relationship between the aforementioned factors and entrepreneurial intention. These findings contribute to the understanding of entrepreneurship education and the development of effective strategies to foster entrepreneurial intentions among students.

Limitations and Future Research

This study has certain limitations that should be acknowledged. Firstly, the sample size of the study was limited to 368 business administration students from three Mongolian universities. Secondly, the data for this study were collected through a self-reported survey, which may have introduced common method bias. Third, the study was constrained in terms of the questionnaire collection process. Only online questionnaires were utilized, and the data was collected during a fixed period.

Future research could investigate the impact of entrepreneurship education on entrepreneurial mindset and intention. Additionally, future research could investigate the potential moderating effects of individual differences, such as gender,

prior experience, or personality traits, on the relationship between entrepreneurial mindset and intentions.

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PREDICTING THE EURO TO CZECH CROWN EXCHANGE RATE

^aMICHAELA JANNOVÁ, ^bPAVEL ROUSEK

*Institute of Technology and Business in České Budějovice,
Okružní 517/10, 370 01 České Budějovice, Czech Republic
email: ^amichaelajannova@mail.vstecb.cz,
^brousek@mail.vstecb.cz*

Abstract: This paper explores the prediction of the exchange rate of the Czech Crown and its market position relative to larger currencies such as the Euro. The study examines the development of the EUR/CZK exchange rate from 2003 to 2023 using neural networks, revealing its volatile tendencies over twenty years. The analysis shows that the exchange rate fluctuated between 22 and 34 without a prolonged period of stagnation. Furthermore, a prediction for the exchange rate in the months of April, May, and June 2023 was conducted, indicating that most neural networks produced similar values and projected no significant increase or decrease. The paper emphasizes that the algorithm of neural networks relies on past values, implying that the actual exchange rate may differ significantly from the predicted outcome.

Keywords: Exchange Rate; Prediction; Euro; Czech Crown.

1 Introduction

The topic of this paper is a prediction of the exchange rate of a selected currency. Specifically, the authors focused on the currency pair Euro to the Czech crown. The euro was introduced 20 years ago and then quickly and confidently took its place as the world's second major currency. At that time, several works appeared that predicted that the euro in the next 10-15 years could surpass the US dollar as the dominant world currency. Currently, the use of the euro in the world is significantly wider than that of other currencies such as the pound and yen. However, the US dollar is still much more popular. Moreover, the last decade has seen a slowdown in the use of the euro in the world and even a decline in some segments in favour of the dollar (Polivach, 2020). The European Union is both an advocate and a symbol of multilateralism in international trade. The rise of the euro's international role may alleviate concerns about spill over brought about by the dollar-dominated global economy (Montfaucon, 2022).

Neck and Weyerstrass (2019) found that EU accession and the introduction of the euro bring a higher real gross domestic product, higher employment, and more sustainable public finances. The benefits of joining the euro area are due to productivity gains. The possibility of central banks issuing digital money is currently being discussed. On 2 October 2020, the European Central Bank presented a report on the issuance of a digital euro in the euro area. It is a way to respond to the growing interest in cryptocurrencies while assessing a possible new mechanism of governance and economic control. However, its benefits do not completely dispel the doubts it still raises (Fernandez, 2021).

Liquidity management is a key task of the central bank. In particular, the reasonable provision of banknotes requires understanding what drives currency demand. This challenge is even greater in the case of the European Monetary Union, where the euro continues to evolve into a well-established currency abroad. In this regard, a new indicator is proposed that reflects the development of foreign demand. In addition to the usual set of determinants, variables including financial and economic policy uncertainty are also considered. A full nominal distribution of banknotes is considered to reveal the diverse role played by several factors. External demand was found to be important for large denominations and that uncertainty was also important for cash demand. In addition, the ECB's recent announcement of the cessation of the issuance of top-denomination banknotes has reduced the overall demand for euro banknotes (Rua, 2020).

Gorman, Orlowski and Roessler (2020) found that the currencies of Central European countries that are not members of the euro area are increasingly moving together with the euro in foreign exchange markets. Gorman, Orlowski and Roessler (2020) from

study the dynamics of cross elasticity between selected Central European currencies (Czech crown CZK, Polish zloty PLN, and Hungarian forint HUF) and euro exchange rates in US dollars based on daily data for the sample period from 4 January 2000 to 5 April 2019. They used the cross-elasticity model originally proposed and tested for EU currencies by Orlowski (2016). To test simultaneous currency movements over time, they used Bai-Perron regression with multiple breakeven points and two-state tests of Markov switching. Furthermore, Gorman, Orlowski and Roessler (2020) found evidence of increasing simultaneous movements of Central European currencies and the euro, which is particularly pronounced in times of financial distress. Current movements in local exchange rates with the euro are also more pronounced during the sovereign debt crisis in the eurozone periphery.

In 1999, when Belgium and Italy joined the euro, they were almost identical in two respects: both had a public debt of 110% of GDP and the same GDP per capita. In 2020, the situation in the two countries was hugely different. Sapir (2020) argues that Italy's troubles were not caused by the euro, as some suggest. On the contrary, as Belgium's experience suggests, Italy could have used the euro to make a fiscal adjustment large enough before the crisis to avoid the harsh adjustment that the crisis eventually necessitated. Radu and Horobet and Belascu (2021) evaluated in their article the benefits and risks of international investments in the Romanian stock market from the perspective of euro investors. They examined the share of exchange rate volatility in the overall risk of these investments over nine years, from January 2011 to December 2019, using monthly values of the Romanian leu and euro exchange rate and monthly values of the Romanian stock index. Radu, Horobet and Belascu (2021) found that the Romanian leu weakened against the euro on average, causing currency losses for the euro investor, which were offset by the average yield of the Romanian index, which was higher than the average yield of the euro area index over the period under review.

It is also necessary to work with information about future economic, political, or other developments. If their development can be predicted, they can then be projected into the monitored variable. Optically, the best option is linear regression, where the curve obtained by the least squares method using negative exponential appears by smoothing. In terms of the correlation coefficient, neural networks are applicable (Horák and Machová, 2019). Many authors have dealt with neural networks in connection with other currencies, such as Vrbka, Horák and Krulický (2022), who used the neural network method to predict the value of the Chinese currency and the influence of oil price developments on the world market. They concluded that fluctuations in oil prices on world markets would affect the CNY/USD price; However, it was not clear to what extent. Vochozka, Horák and Šuleř (2019) used artificial neural networks for exchange rate prediction, which have brought high-quality and valuable results in several research programs. Data on currency exchange rates for a period longer than 9 years (a total of 3303 input data) were used for the analysis. Vochozka, Horák and Šuleř (2019) found that when aligning time series, other variables (such as year, month, and day) had higher accuracy.

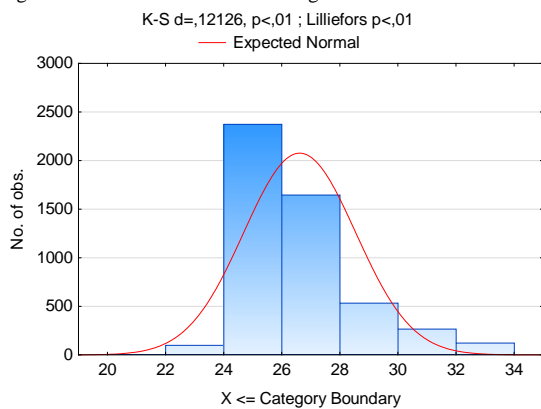
In the past, exchange rate forecasting models performed poorly outside the sample and were worse than the random walk model. Monthly panel data from 1973 to 2014 for ten OECD currency pairs are used for out-of-sample forecasts using artificial neural networks and XGBoost models. Most approaches show the significant and considerable informative value of directional forecasts. Moreover, evidence suggests that information regarding forecast timing is a key component of forecasting performance (Pfahler, 2022).

2 Materials and Methods

To analyse the problem, i.e., to predict the exchange rate of the selected currency (in this case EUR/CZK), the neural networks method will be used. It will be used to predict the price of the euro for the next 60 trading days. The data will be used from the Yahoo.com website from 2003-2023, where the prices of a given currency are during each day that the currency was traded on the stock markets. Daily data from the New York Stock Exchange will be used. The New York Stock Exchange uses two indices. One is the NYSE Composite Index, which is used for all traded titles, and the other is the DJIA (Dow Jones Industrial Average), which serves the 30 largest stock companies in the US. The New York Stock Exchange is traded every day from 9:30 a.m. to 4:00 p.m. local time (in the Czech Republic it is around 3:30 p.m. to 10:00 p.m.). The price is determined every business day, except when the U.S. is a public holiday.

The basic statistical characteristics of the used time series of the EUR/CZK price are shown in the following figures 1-3.

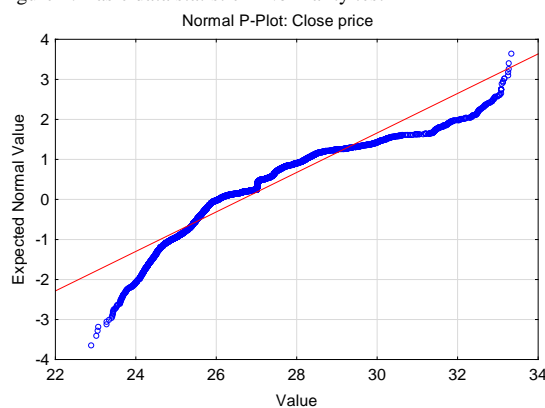
Figure 1: Basic data statistic – Histogram



Source: Authors

As you can see from the figure, the histogram has a normal distribution and the data that was used to construct the histogram was fine. The histogram should always have the shape of a "scoop". This histogram shows that the data was in the range of 22 to 34. 5047 data were used to construct this histogram.

Figure 2: Basic data statistic – Normality test

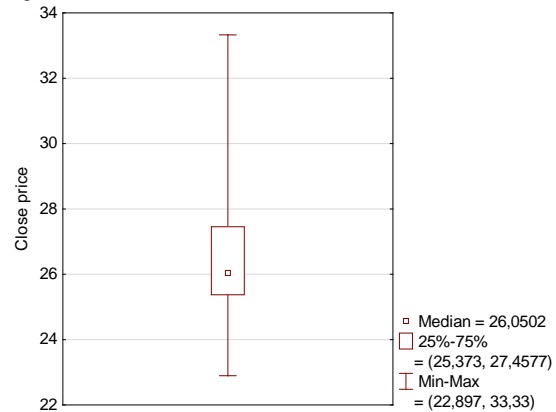


Source: Authors

The normality test makes it possible to assess whether the observed values come from some known probability distribution. If the sample distribution of data coincides with the theoretical distribution, all points lie in a straight line. If the sample and theoretical distributions do not match, the displayed points will form a curve different from the straight line. This figure shows that the sample distribution almost coincides with the theoretical distribution. Only at the beginning and at the end are the values

different from the straight line. From this point of view, the data used can therefore also be considered relevant.

Figure 3: Basic data statistic – Variance



Source: Authors

This figure shows that the variance was from 23 to 33, with the minimum value of 22.90 and the maximum value of 33.33. The median, in this case, was 26.05. It can also be seen that the highest values in the monitored period ranged from 25.37 to 27.46.

The data obtained will be evaluated using TIBECO's Statistica 13 software. First, we will create linear regression and as the next step, we will use neural networks for regression. We will examine the linear analysis on a sample for which we have determined the following functions: linear, polynomial, logarithmic, exponential, polynomial weighted distances, and polynomial negative exponential smoothing. First, the correlation coefficient will be calculated, that is, the dependence of the euro price on time, and a confidence level of 0.95 will be used, followed by regression using neural structures. Two types of networks will be constructed, namely MLP networks and RBF networks. For this purpose, 5047 data will be used, and the independent variable in our case will be time and the dependent variable will be the price of the currency. Time series (testing, training, and verification) will be divided into three groups. Each of these groups must contain a certain percentage of the data that will create neural structures. Training has 70% of the data, testing, and verification then 15% each. The test and verification groups are used to verify the reliability of the neural structure found. 1000 neural networks are used for the calculation and 10 neural networks are preserved. For MLP networks, a minimum of 2 neurons will be used, but the maximum will be 20 neurons, and for RBF networks, a minimum of 10 neurons will be used in the hidden layer, but the maximum will be 30 neurons. And for these two networks, the following functions will be used: linear, logistic, Atanh, Exponential, and Sine. We leave the other settings as default (within the ATS Automatic Mesh tool).

3 Results

Table 1 shows the 10 neural networks with the best characteristics out of 1000 generated neural structures.

Tab. 1: Summary of active networks (EUR/CZK – daily data 2003-2023)

Index	Net. Name	Train. Perf.	Test Perf.	Valid Perf.	Train. Error	Test Error	Valid Error	Train. Alg.	Error Function	Hidden Activation	Output Activation
1	MLP (1,15,1)	0.983259	0.981622	0.985005	0.061198	0.065805	0.056042	BPFS (388)	SOS	Tanh	Logistic
2	MLP (1,14,1)	0.981650	0.979722	0.984382	0.067175	0.072506	0.058448	BPFS (389)	SOS	Logistic	Logistic
3	MLP (1,18,1)	0.981992	0.980536	0.984624	0.065789	0.069684	0.057616	BPFS (435)	SOS	Logistic	Expon.
4	MLP (1,15,1)	0.980994	0.984062	0.986784	0.054541	0.057205	0.049498	BPFS (461)	SOS	Logistic	Logistic
5	MLP (1,15,1)	0.982721	0.980997	0.985049	0.063147	0.068078	0.056036	BPFS (389)	SOS	Logistic	Logistic
6	MLP (1,14,1)	0.982586	0.980555	0.985019	0.063644	0.069689	0.056281	BPFS (389)	SOS	Tanh	Logistic
7	MLP (1,15,1)	0.983067	0.981367	0.985398	0.061900	0.066719	0.054647	BPFS (435)	SOS	Logistic	Expon.
8	MLP (1,15,1)	0.982620	0.980622	0.984827	0.063476	0.069448	0.056836	BPFS (362)	SOS	Logistic	Identity
9	MLP (1,15,1)	0.986505	0.985521	0.988213	0.049423	0.051876	0.044085	BPFS (672)	SOS	Tanh	Expon.
10	MLP (1,14,1)	0.982813	0.980901	0.985182	0.062814	0.068398	0.055906	BPFS (327)	SOS	Logistic	Logistic

Source: Authors

As can be seen from Table 1, all the networks that have been preserved belong to MLP networks. It follows that the RBF networks met the performance parameters but had worse errors than the retained MLP networks. In the hidden layer, these stored networks had from 13 to 20 neurons and were created using the BFGS (Broyden-Fletcher-Goldfarb-Shanno) training algorithm, always in a different variant. To activate the hidden layer of neurons, the hyperbolic tangent and the logistic function had to be used, and three functions were used for the outer layer – logistic function, exponential function, and identity function. What is important is the correlation coefficient, which determines the performance of all stored networks in individual data sets.

Tab 2: Correlation coefficients (EUR/CZK – daily data 200 3-2023)

	Price Train	Price Test	Price Validation
1.MLP 1-13-1	0.983259	0.981622	0.985005
2.MLP 1-14-1	0.981610	0.979722	0.984382
3.MLP 1-18-1	0.981992	0.980536	0.984624
4.MLP 1-19-1	0.985094	0.984062	0.986784
5.MLP 1-15-1	0.982721	0.980997	0.985049
6.MLP 1-9-1	0.982586	0.980555	0.985019
7.MLP 1-20-1	0.983067	0.981367	0.985398
8.MLP 1-19-1	0.982630	0.980622	0.984827
9.MLP 1-20-1	0.986503	0.985521	0.988213
10.MLP 1-14-1	0.982813	0.980901	0.985182

Source: Authors

The value of the correlation coefficient should always ideally be 1, which is why they try to find the neural network that most closely corresponds to this value. It is also important that all groups (training, testing and verification) have the same performance. It is therefore obvious that all structures that were created using the training data set are valid and subsequently verified on the next two data sets. It is also essential that in all data sets the neural network shows minimal error. As can be seen from Table 2, in all cases the value of correlation coefficients is higher than 0.979 for all neural networks and the differences between individual neural networks are minimal. It can therefore be said that the data is of extremely high quality. Also especially important is Table 3, which records the analysis of prediction statistics.

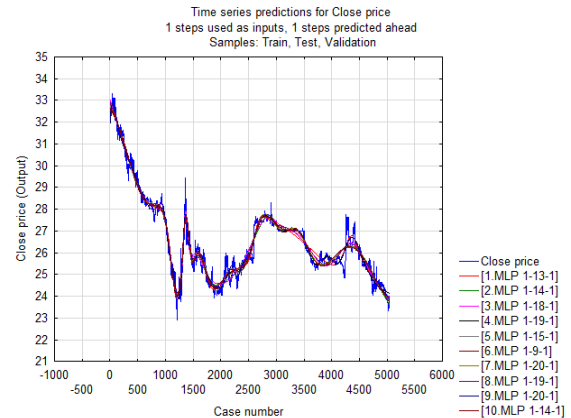
Tab. 3: Predictions statistics (EUR/CZK – daily data 2003-2023)

	1.MLP 1-13-1	2.MLP 1-14-1	3.MLP 1-18-1	4.MLP 1-19-1	5.MLP 1-15-1	6.MLP 1-9-1	7.MLP 1-20-1	8.MLP 1-19-1	9.MLP 1-20-1	10.MLP 1-14-1
Minimum Prediction (Train)	23.87282	23.62950	23.95749	24.00041	23.82133	23.86179	23.74859	23.88438	23.83938	23.72466
Maximum Prediction (Train)	32.73145	32.60002	33.05219	32.80494	32.74624	32.57954	32.82503	32.89649	32.86008	32.65979
Minimum Prediction (Test)	23.87311	23.64474	23.96496	24.00059	23.83381	23.87342	23.76116	23.88442	23.85556	23.73884
Maximum Prediction (Test)	32.68272	32.53948	32.89751	32.72720	32.67707	32.52166	32.73476	32.78998	32.86059	32.59220
Minimum Prediction (Validation)	23.87217	23.62968	23.95626	24.00261	23.81926	23.85986	23.74651	23.89689	23.83669	23.72221
Maximum Prediction (Validation)	32.67549	32.53089	32.87668	32.71610	32.66788	32.51344	32.72215	32.77078	32.86078	32.58263
Minimum Residual (Train)	-1.24302	-1.30282	-1.38997	-1.23659	-1.36102	-1.36446	-1.32998	-1.36280	-1.19276	-1.34303
Maximum Residual (Train)	1.95751	1.78228	1.60347	1.87788	1.66408	1.87065	1.72503	1.93883	1.68021	1.84357
Minimum Residual (Test)	-1.31383	-1.36118	-1.45225	-1.27898	-1.41968	-1.42415	-1.38862	-1.42401	-1.26296	-1.40126
Maximum Residual (Test)	1.25902	1.41368	1.26696	1.29779	1.35332	1.33432	1.36699	1.31157	1.32128	1.37713
Minimum Residual (Validation)	-1.09614	-1.28625	-1.38249	-1.23448	-1.38158	-1.30784	-1.35934	-1.22460	-1.27052	-1.27911
Maximum Residual (Validation)	1.32473	1.40772	1.27925	1.35995	1.34744	1.33320	1.36706	1.31826	1.38264	1.37234
Minimum Standard Residual (Train)	-5.02468	-5.02665	-5.41912	-5.29499	-5.41613	-5.40860	-5.34563	-5.40912	-5.36524	-5.35870
Maximum Standard Residual (Train)	7.91285	6.87665	6.25151	6.04092	6.62212	7.41507	6.93346	7.69546	7.55786	7.35883
Minimum Standard Residual (Test)	-5.12166	-5.05508	-5.50143	-5.34744	-5.44112	-5.39477	-5.37985	-5.40360	-5.54510	-5.35796
Maximum Standard Residual (Test)	4.90801	5.25003	4.79951	5.42609	5.18681	5.05449	5.29224	4.97692	5.80112	5.26566
Minimum Standard Residual (Validation)	-4.63030	-5.32035	-5.75958	-5.54869	-5.83637	-5.51283	-5.81497	-5.13670	-6.05114	-5.42926
Maximum Standard Residual (Validation)	5.95888	5.82282	5.32948	6.11267	5.69215	5.61969	5.84795	5.52956	6.58514	5.82486

Source: Authors

This table shows the analysis of prediction statistics. Residue levels can be seen here. Residues should ideally approach the value of 0, meaning that the input data's value corresponds to the predicted value. Here we see that they show some network residues and the; therefore, they cannot be said to be accurate. In the following Figure 1, these residues are shown graphically, where all the networks and the actual value history of the currency are.

Figure 4: Evolution of the Euro price vis-à-vis the Czech crown



Source: Authors

Figure 4 shows that all neural networks in total managed to exactly copy the actual price movement. The coloured lines represent the ten preserved neural networks. But these neural networks cannot capture local minimum and maximum extreme fluctuations. For example, at 1200, there was an extreme downward swing, when the price of the euro fell, and neural networks did not notice this swing. This is because the Global Financial Crisis began in 2008. The figure also shows that the price of the euro fell from 2003 until 2008. Then it rose again very quickly. And it can also be seen that until 2023, the price of the euro has continued to fluctuate up and down. It is questionable to what extent they are the result of a turbulent environment that none of the preserved neural networks could reliably describe. However, despite this fact, we can accept the statement that all preserved neural networks are applicable in practice.

4 Discussion

Following the training of neural networks, predictions of oil prices for the next 60 trading days were made. In Table 4 you can see how the price will move just for the mentioned 60 trading days.

Tab. 4: Euro price prediction for the month of April, May, and June 2023

Date	1. Close	2. Close	3. Close	4. Close	5. Close	6. Close	7. Close	8. Close	9. Close	10. Close
04.04.2023	23.5127	23.6802	24.04678	23.67294	23.72831	23.53376	23.57027	24.14276	23.79681	23.08824
05.04.2023	23.50555	23.67757	24.04554	23.66814	23.72508	23.52842	23.56639	24.14186	23.79602	23.07901
06.04.2023	23.49780	23.67504	24.04429	23.66312	23.71985	23.52307	23.56250	24.14095	23.79154	23.07010
07.04.2023	23.49002	23.67250	24.04308	23.65848	23.71562	23.51752	23.55862	24.14005	23.79106	23.06148
08.04.2023	23.48226	23.66992	24.04182	23.65382	23.71139	23.51225	23.55078	24.13915	23.78630	23.05287
11.04.2023	23.45587	23.66240	24.03808	23.63092	23.69857	23.50330	23.54207	24.13645	23.78116	23.03802
12.04.2023	23.45063	23.65983	24.03683	23.62598	23.69443	23.49884	23.53918	24.13555	23.77869	23.02289
13.04.2023	23.44266	23.65736	24.03559	23.62101	23.69019	23.49488	23.53530	24.13466	23.77623	23.01605
14.04.2023	23.43466	23.65485	24.03435	23.61603	23.68594	23.49021	23.53141	24.13376	23.77376	23.00948
17.04.2023	23.41046	23.64731	24.03061	23.60994	23.67720	23.47710	23.51974	24.13109	23.76639	22.99142
18.04.2023	23.40233	23.64483	24.02937	23.60387	23.66885	23.47273	23.51585	24.13020	23.76393	22.98492
19.04.2023	23.39417	23.64234	24.02812	23.59878	23.66470	23.46835	23.51196	24.12932	23.76148	22.97807
20.04.2023	23.38598	23.63984	24.02688	23.59367	23.66048	23.46397	23.50807	24.12843	23.75901	22.97166
21.04.2023	23.37776	23.63734	24.02563	23.58858	23.65620	23.45959	23.50417	24.12754	23.75659	22.96562
24.04.2023	23.35299	23.62980	24.02188	23.57299	23.64345	23.44642	23.49250	24.12490	23.74926	22.95801
25.04.2023	23.34454	23.62742	24.02065	23.56776	23.63920	23.44203	23.48880	24.12402	23.74683	22.95144
26.04.2023	23.33616	23.62495	24.01940	23.56251	23.63495	23.43764	23.48471	24.12315	23.74439	22.94507
27.04.2023	23.32774	23.62248	24.01816	23.55724	23.63070	23.43324	23.48082	24.12227	23.74196	22.93870
28.04.2023	23.31929	23.62001	24.01691	23.55195	23.62645	23.42884	23.47692	24.12140	23.73953	22.93232
01.05.2023	23.2976	23.61262	24.01317	23.53993	23.61371	23.41563	23.46254	24.11878	23.73216	22.92494
02.05.2023	23.28519	23.61017	24.01192	23.53464	23.60946	23.41122	23.46114	24.11791	23.72978	22.91825
03.05.2023	23.27568	23.60771	24.01068	23.52934	23.60522	23.40681	23.45714	24.11706	23.72743	22.91191
04.05.2023	23.26784	23.60525	24.00943	23.52405	23.60098	23.40240	23.45255	24.11618	23.72502	22.90571
05.05.2023	23.25927	23.60282	24.00818	23.51874	23.59673	23.39798	23.44895	24.11531	23.72261	22.89956
06.05.2023	23.23306	23.59549	24.00444	23.49773	23.58403	23.38472	23.43796	24.11273	23.71639	22.89176
09.05.2023	23.22426	23.59306	24.00319	23.49218	23.57980	23.38029	23.43406	24.11187	23.71399	22.88510
10.05.2023	23.21543	23.59061	24.00194	23.48660	23.57575	23.37586	23.43016	24.11101	23.71160	22.87845
11.05.2023	23.20657	23.58820	24.00069	23.48100	23.57134	23.37143	23.42626	24.11015	23.70920	22.87180
12.05.2023	23.19767	23.58578	23.99944	23.47537	23.56712	23.36700	23.42236	24.10930	23.70681	22.86517
15.05.2023	23.17079	23.57823	23.99770	23.45824	23.56047	23.35989	23.41666	24.10874	23.70509	22.85922
16.05.2023	23.16176	23.57611	23.99645	23.45262	23.55626	23.35522	23.40976	24.10809	23.70369	22.85311
17.05.2023	23.15271	23.57370	23.99520	23.44697	23.55203	23.35054	23.40286	24.10744	23.70229	22.84706
18.05.2023	23.14362	23.57129	23.99395	23.44129	23.54781	23.34586	23.39596	24.10679	23.70092	22.84101
19.05.2023	23.13449	23.56889	23.99270	23.43529	23.54359	23.34119	23.39106	24.10614	23.69955	22.83507
22.05.2023	23.11009	23.56170	23.98695	23.41773	23.52509	23.32259	23.38335	24.10081	23.69035	22.83447
23.05.2023	23.09768	23.55930	23.98570	23.41182	23.52091	23.31809	23.37945	24.09997	23.68799	22.82877
24.05.2023	23.08840	23.55692	23.98445	23.40589	23.51673	23.31363	23.37554	24.09913	23.68573	22.82322
25.05.2023	23.07908	23.55453	23.98320	23.39991	23.51256	23.30917	23.37164	24.09829	23.68348	22.81801
28.05.2023	23.05678	23.54519	23.98195	23.38399	23.50589	23.30470	23.36773	24.09745	23.68122	22.81324
29.05.2023	23.04150	23.54502	23.97920	23.37583	23.49994	23.29130	23.35602	24.09694	23.67955	22.80813
30.05.2023	23.03202	23.54265	23.97604	23.36974	23.49179	23.28683	23.35212	24.09611	23.67788	22.80379
31.05.2023	23.02251	23.54029	23.97569	23.36362	23.48766	23.28234	23.34821	24.09528	23.67609	22.80048
01.06.2023	23.01296	23.53792	23.97444	23.35748	23.48353	23.27787	23.34431	24.09445	23.67435	22.80019
02.06.2023	23.00339	23.53556	23.97319	23.35131	23.47940	23.27338	23.34040	24.09362	23.67264	22.80092
05.06.2023	22.97447	23.52850	23.96944	23.33262	23.46708	23.25993	23.32968	24.08913	23.66927	22.80025
06.06.2023	22.96476	23.52615	23.96818	23.32634	23.46298	23.25544	23.32478	24.08831	23.66760	22.80096
09.06.2023	22.93670	23.52081	23.96693	23.32002	23.45889	23.25094	23.32087	24.08749	23.66593	22.80069
08.06.2023	22.94259	23.52147	23.96568	23.31368	23.45481	23.24647	23.31696	24.08666	23.66423	22.80087
09.06.2023	22.93545	23.51913	23.96443	23.30732	23.45074	23.24195	23.31305	24.08584	23.66255	22.80089
12.06.2023	22.90585	23.51213	23.96067	23.29804	23.44856	23.23845	23.30133	24.08509	23.66089	22.80082
13.06.2023	22.89992	23.50980	23.95942	23.29156	23.44452	23.23394	23.29742	24.08427	23.65929	22.80112
14.06.2023	22.88959	23.50748	23.95817	23.28504	23.44049	23.21943	23.29351	24.08376	23.65765	22.80082
15.06.2023	22.87955	23.50516	23.95692	23.28050	23.43646	23.21492	23.28961	24.08304	23.65621	22.80074
16.06.2023	22.86992	23.50284	23.95566	23.26993	23.43245	23.21041	23.28570	24.08213	23.65492	22.80076
19.06.2023	22.85964	23.49991	23.95191	23.24204	23.41046	23.19685	23.27797	24.07770	23.65107	22.80066
20.06.2023	22.85458	23.49660	23.94966	23.23016	23.40668	23.19271	23.27366	24.07689	23.64798	22.80071
21.06.2023	22.85125	23.49130	23.94840	23.22063	23.40251	23.18781	23.26935	24.07608	23.64575	22.80056
22.06.2023	22.85006	23.48900	23.94815	23.21188	23.39855	23.18328	23.26224	24.07528	23.64305	22.80051
23.06.2023	22.79480	23.48671	23.94600	23.21510	23.39460	23.17875	23.25833	24.07447	23.64098	22.80047
26.06.2023	23.178451	23.48441	23.94505	23.30829	23.39066	23.17422	23.25442	24.07367	23.63973	22.80043

Source: authors

In Table 4 it is possible to see how the price of oil will move in the period from 4.04.2023 to 24.06.2023. Most neural networks show remarkably similar values. And the fact that the price of the EUR to CZK will be around 23.5 in the coming months. Only the 3rd and 8th neural networks show a higher price, about 24 CZK. Interestingly, there are no major price fluctuations in either of the neural networks. All of them have a higher price at the beginning of the period, which decreases during the monitored period and increases again towards the end of most neural networks.

5 Conclusion

The topic of this paper was the prediction of the exchange rate of a selected currency and the euro currency was chosen. It has been found that the euro has an extraordinarily strong market position but cannot yet compete sufficiently with larger currencies such as the US dollar. This work also investigated the development of the euro price from 2003 to 2023 using neural networks. It was found that the euro had very volatile tendencies over twenty years and that there was hardly any period when the price was stagnant but still fluctuated between 22 and 34. A prediction of the euro price for three months ahead was also prepared. Specifically, for the months of April, May, and June 2023. It was found that most neural networks had similar values, and the price of the euro did not increase or decrease dramatically. This is because the algorithm of neural networks takes the previous values from the past days and follows them. It is therefore possible that in the end, the price of the euro will be completely different.

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Primary Paper Section: A

Secondary Paper Section: AH

SELECTED ASPECTS OF THE POLITICAL LINGUISTIC LANDSCAPE

^aPETRA JESENSKÁ

*Department of English & American Studies, Faculty of Arts,
Matej Bel University, 40 Street Tajovského, 974 01 Banská
Bystrica, Slovakia
email: ^apetra.jesenska@umb.sk*

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Abstract: The paper captures a cross-section of the dynamics of the semiotic political linguistic landscape (PLL) in Banská Bystrica. The PLL is perceived as a linguistic landscape (LL) used for political purposes, i.e. the LL that is used to express a political stance in order to agitate, argue and defend specific politically attuned positions. The urban space contains reminiscences of the electoral struggle ahead of the 2022 local elections. The main objective was to analyse and compare chosen PLL with a time interval of one year. The author also notes the LL immediately after the Russian invasion of Ukraine in March 2022 and the reflection of these events in the semiotics of the LL. She confronts this spacial-temporal moment with the current state of affairs in March 2023. Through the methods of observation, description, analysis, and comparison, the author comes to conclusion about the misuse of the themes of war and war refugee and leavers for political reasons reflected in the LL semiotics. The research results show value clashes reflected by the layering of the studied signs, which are manifested by dialogicality and expressiveness often caused by the anonymity of their interlocutors. The study concludes that the dynamics of the LL narrative is strongly influenced by the state of war in the neighbouring country, not only in the static signs but also in the mobile signs found and examined in the LL.

Keywords: linguistic landscape, multimodal sign, wartime, warscape

1 Introduction

The object of research interest is the political, especially wartime, linguistic landscape (LL) and its continuous shift into the virtual space where it finds a wider range of recipients (resp. interlocutors). Manifestations of the *warscape* (blended from the compound *war landscape*) are a variety of static and mobile multimodal signs. Static signs include buildings, façades, billboards, flags, etc. Mobile ones include cars, signs on clothing, etc.

It would be a mistake to assume that the wartime LL can only be located in a country where a war is currently being fought by traditional means (i.e. a war in some "narrow" sense). Slovakia, as a member of the Euro-Atlantic structural relations, has been in a hybrid war for a long time, to which it has been exposed by the Russian Federation through hoaxes, disinformation and pro-Russian propaganda disseminated mainly on social networks (especially Facebook profile statuses of the Embassy of Russia in Slovakia), but also others. Citizens of Slovakia, the Czech Republic, and other European countries calling for peace ignore the fact that the aggressor is the Russian Federation, whose representatives are of the opinion that "The goals that Russia has set for itself in Ukraine can now only be achieved by military means" (Peskov, www.facebook.com/ambasadarus, 13/3/2023). Protests against the war (or for "peace") in front of the US embassy, in front of the Slovak National Council, in front of the Grasalkovich Palace in Bratislava, or in front of the National Museum in Prague (Wenceslas Square, etc.) and elsewhere are meaningless unless they take place in front of the Russian embassy, or the Russian consulate, etc.

2 Objectives, Materials and Methods

The main objective is to observe, capture, describe, analyse, and compare urban area of the examined LL with a time interval of one year. The term political linguistic landscape (PLL) was studied and defined within the framework of the linguistic landscape background (see below). The study observes and describes a selected slice of the LL, approaching it in an analytical-interpretive manner. The investigation focuses on the qualitative analysis of politically oriented speeches of selected multimodal signs in Banská Bystrica (BB) LL with an emphasis on the war situation in the neighbouring country after the invasion of the territory of Ukraine (UA) by the troops of the Russian Federation (RF) on 24/2/2022 to the present. The

subject of the investigation are static and mobile signs located mainly in the inner city of BB, however, the universal validity of their content is also demonstrated by examples from LL other cities in the neighbouring Czech Republic. Important factors were their accessibility, reliability, exposure of the given LL space (i.e., coverage of the number of potential recipients), thematic focus, and contextualized topicality, i.e., thematization of contemporary war events in the UA.

After 2022 collection, classification, description and qualitative analysis, we proceeded to the interpretation of the investigated signs with subsequent comparison with other signs collected in 2023. The thematic and value universality of the shared ideas in the public space is confirmed precisely by the dynamics of dialogicity mediated by the influence of the accessible LL to citizens, i.e., to the interlocutors for whom is the LL intended. And they react, communicate and polemicize with their LL, i.e. with other interlocutors - the author and commissioner of the medium thus becomes the creator of the LL as well as the reacting interlocutor expressing clear agreement or disagreement with the medium's narrative. (Co)LL creators thus convey their positions publicly (though often anonymously) in the actual geopolitical context in a given spacial-temporal context.

The range of potential communicants is widening due to the intermingling of the real urban space of LL with the virtual world of social networks, which have become a suitable source for collecting research material. These were mainly Facebook, Twitter and Instagram. Thus, we explore the interconnection of warscape-oriented LL with the cyberscape and the netscape, respectively (cf. Tóth - Istók - Lörincz, 2022). The time range of data collection is from March in 2022 to March in 2023 in location of the BB urban area. The data are stored as visual-text files. We have observed the given media in the current geopolitical context and compared them with other media in the neighbouring country.

3 Political Linguistic Landscape

It is a term referring to LL carrying political statements, opinions, promises, appeals and attitudes. In general, in terms of LL research "multimodality as a term refers to images (signs) that combine with linguistic elements, thus enhancing the informative value of the sign" (Molnárová, 2021, p. 209). "Our" LL is characterized by a billboardization bordering on visual smog. In the case of a billboard, it is a semiotic "visual-verbal communication" (Klincková, 2014, p. 88) placed mainly in an exposed urban space focused on the largest possible number of potential recipients (i.e. customers, interlocutors, etc.) The SSSJ A - G (SSSJ, 2006) defines a billboard as "a large panel designed for outdoor advertising, usually located along highways and roads, an eye-catcher". According to Mistrík (1975, pp. 133-134), the billboard represents a means of communication of rapid dialogue with the addressee, who is in constant motion. The billboard, as a static, yet compact communication, needs to effectively (i.e. quickly, clearly, unambiguously, comprehensibly and legibly) communicate an economically accurate message targeted at a mobile recipient. This requires expressiveness, creativity, colourfulness, emotionality, readability, contextual topicality, as well as brevity (cf. Klincková, 2014, pp. 89-91). Non-linguistic means of expression play an equally important role as linguistic signs (expressions, syntagmas, logonyms, etc.), if not more so, because they can be (and often are) signs of intense symbols and expressive messages conveyed through graphics, images, colour, or overall composition in updated geopolitical contexts.

4 Results and Discussion

The Slovak and Czech LL also dynamically react to the current situation (see figures 1, 4, 5, 6, 7, 8, 9, 10 and 11) since the beginning of the Russian invasion of Ukraine (24/2/2022).

Currently (September 2022 – March 2023), a billboard (Fig. 1) reacting to the war events with the text "We have given enough to the Ukrainians, let's help the Slovaks already!" is located in the intramural area of the Fončorda quarter (Nové Kalište Street) in Banská Bystrica. It is an election billboard spreading the narrative of disproportionate help to Ukrainian war refugees or leavers (mostly mothers with young children). The communication suggests that political leaders do not pay enough attention to the problems of Slovak citizens or that they prefer the interests of refugees at the expense of the domestic population. The communication reinforces this impression of 'patriotism' not only in the verbal but also in the visual plane (several folkloric motifs). Patriotism is presented in the verbal plane ("let's help Slovaks", "people's candidate"), in which the contrast between us ("Slovaks") and them ("Ukrainians") is implicitly present. At the same time, there is a graphic highlighting the phenomenon explicitly in the form of the party's logo with the motif of the Fatra, Tatra and Matra Triple Cross symbolism. A reference to 'folkness' and folk traditions in the form of a distinctive blue embroidery with a folklore motif on a white shirt (as a prototype of a Slovak national costume). The political-military LL thus becomes a part of the pre-election fight for the position of the chairman of the Banská Bystrica region (i.e. mayor) during autumn municipal elections in 2022. The billboard was still available in the intravillan area in March 2023, i.e. $\frac{3}{4}$ of the year after the autumn elections of 2022.



Figure 1 Nové Kalište1 in BB
Source: Author's own archives (March, 2023)

The counterpart of billboard 1 (Fig. 1) is billboard 2 (see Fig. 2), which is placed on the opposite side of the carrier (sign) and was still available in March 2023 as a reminiscence of the municipal election period in order to address the electorate of the municipal elections. As in the previous case, it addresses potential voters in a combination of graphics (a likeness of a candidate for mayor/member of the county with his/her name and surname) and text (proper nouns, candidacy, promise, appeal). Election promise "I will serve you, and not the oligarchs!" gives the recipients the idea that the current representatives of the city serve the oligarchs at the expense of the citizens of the city. This phenomenon is highlighted by the vague and unaddressed appeal "stop the dark city!" and we ask who is to "stop" the dark city? What makes it "dark"? Alleged cooperation with alleged oligarchs?



Figure 2 Nové Kalište2 in BB
Source: Author's own archives (March 2023)

Both billboards (Figure 1 and Figure 2) are located in an exposed location near a well-known grocery chain with a solid customer base (Figure 3). Moreover, the popular grocery store (Fig. 3) has a good access to the main road and is situated near the exit of the city, which increases its footfall and thus makes its surroundings interesting for advertisers and positioners of various (not only politically oriented) carriers in the linguistic landscape.

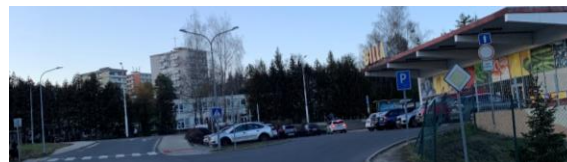


Figure 3 Nové Kalište3 in BB
Source: Author's own archives (March 2023)

An appropriate example of the impact of political language landscape on city participants is the billboard below (Figure 4) from Hradec Králové, Czech Republic, in March 2022, appealing for the purchase of arms for UA. In addition to the image of the Ukrainian president casually dressed in khaki colours (thus referring to the state of war in his country), the appeal text ("The real president. Buy him weapons!"), the banner includes a link to a website with an account number and a QR code for electronic payment. President Zelensky's own name is not mentioned on the billboard at all because it is assumed that he is so well-known that it is unnecessary. The billboard was placed in the city near the main train station by the activist civic association *Let's Talk Together*, to which the advertising company BigMedia rented commercial space for three months. About halfway through the lease, BigMedia had the billboard removed, arguing that the town's citizens had complained about the medium (Moláčec, 2022).



Figure 4 Billboard in Hradec Králové (Czechia, 2022)
Source: *Mluvme spolu* (Moláčec, 2022)

On THK Street (Trieda Hradca Králové/Hradca Králové Street) in Banská Bystrica something similar occurred with the difference that the "communication" took place directly on the billboard carrier in the public space in front of passers-by. Just after the Russian invasion in March 2022, a series of billboards appeared all over the Slovak (linguistic) landscape depicting the Ukrainian flags with a legendary statement by the former Czechoslovak (and later Czech) president V. Havel that "Truth and love will triumph over lies and hatred". Such a series of three billboard signs were placed at the aforementioned Banská Bystrica THK in early March 2022. In a short time, the sign was responded to by the anonymous author(s) with a capital letter "Z" referring to the pro-Russian denotation of "for" of "in favour": "for the (Russian) Motherland" (not recognizing Ukraine's territorial integrity or its right to a sovereign independent state, rejecting the participation of the Russian Federation in decision-making processes on the foreign as well as domestic political direction of Ukraine), "for Putin", i.e. "for war", "for sending troops to the territory of the UA", "for invading a neighbouring state" (see Fig. 5 below).



Figure 5 THK in BB (2022) with two message layers

Source: <https://bystrica.dnes24.sk/galeria/v-obrazoch-na-billboardy-v-ukrajinskych-farbach-nieko-nasprejoval-symbol-z-99440/fotografia-3?articleId=412151>

However, this was not the end of the "communication" in LL at THK in BB. The anonymous author/group used the white colour to crossed out the red letter "Z" and wrote their message in Cyrillic directly addressing the Russian president (see Fig. 6), sending him to the place where, at the beginning of the war, the Ukrainian defender had sent the Russian warship. The previous quotation of an UA soldier became topical and contextualized similar way as the Havel' quote on Fig. 5. Both value and opinion clashes take place publicly on the ground of a publicly accessible medium fulfilling the role of a kind of public "bulletin board" providing enough space for passers-by to engage effectively due to its size, good readability, persistence of the message, etc.



Figure 6 THK in BB (2022) with three message layers

Source: <https://bystrica.dnes24.sk/galeria/v-obrazoch-na-billboardy-v-ukrajinskych-farbach-nieko-nasprejoval-symbol-z-99440/fotografia-3?articleId=412151>

The semiotic political linguistic landscape in March 2023 at the THK in BB looks like this:



Figure 7 THK BB (2023)

Source: Author's own archives (March 2023)

The top-down sign in Figure 7 refers not only to the values of peace and freedom, but also to energy independence (meaning from the RF, from which EU Member States have imported oil and natural gas in the past). Complete energy self-sufficiency is

not possible in the EU situation yet, but independence from a war aggressor is, and so is diversification of resources. The medium targets the young generation not only graphically (illustration of young people), but also by means of a nod ("You are Europe."), thus involving the young interlocutor in European and domestic public affairs. The motif of the Ukrainian flag is represented in the form of blue-yellow graphics throughout the medium.

Hence, urban public space becomes a place-value-bearer for the expression of personal civic stance not only within large-scale signs, but also for private residents who aspire to enter the socio-political narrative (see Figure 8 below). At the same time, this space in the current technically advanced era provides the conditions for a certain degree of interactivity in the sense of "if I share, I can be shared" or "my sharing will be shared" and commented on at the same time, e.g. on social networks as in Figure 9 below. Sharing does not only work within a given social network, but also outside it. An LL captured and shared within a profile on one social network (e.g. on Facebook as in Figure 8) can be shared on another social network (e.g. on Twitter as in Figure 9).

Thus, LL enters the narrative of the polemics of the war landscape by stepping out of the private sphere (private apartment) into the public sphere (balcony facing the street shared on a social network) in the form of a Czech and Russian flags positioned in such a way as to make it obvious with whom the author sympathizes. To be sure, he explains his position:

"If a yellow-blue cloth [referring to the Ukrainian national flag, explained by PJ] can hang on the National Museum [he means the National Museum in Prague 11/3/2023., supplemented by PJ]", then why shouldn't red-blue-white flags [referring to the flag of the Czech Republic and the flag of the Russian Federation, explained by PJ] be hanging on my balcony. That's not supporting Russia. Unlike the director of the National Theatre, I obey the law. I have two flags. The Czech one as seen from the outside on the right, the other on the left. Glory to the Czech Republic [referring to the password-hello Glory to Ukraine, expl. by PJ]."

The author of the translated Facebook status above makes clear his clear value position through axiological (evaluative) expressions - "yellow-blue rag", "red-blue-white flags", "if it can...on the National Museum...why not on my balcony...", "it is not support", "glory to the Czech Republic" (Fig. 8).



Figure 8 LL on Facebook

Source: <https://www.facebook.com/profile.php?id=100069688525360> (13/3/2023)

OstraVanda's Twitter profile sharply contradicts (14/3/2023) the status posted by Aldo Svoboda's profile (13/3/2023) by declaring "To make it clear from afar that Ales is a stupid moron" (fig. 9).



Figure 9 Twitter status
Source: Twitter.com

One of the disadvantages of sharing value preferences is that anyone can react to anything anytime, i.e. not only according to their preferences, but also to the cognitive competence of the interlocutor, e.g. by pointing out that he did not place the flag of the Russian Federation correctly, to which the communicant responds with a new status (see Fig. 10):



Figure 10 Commented LL on Facebook
Source: <https://www.facebook.com/profile.php?id=100069688525360> (14/3/2023)

The statuses captured in the Fig. 8 and Fig. 10 refer to a specific situation of a clash between several citizens and the police in front of the National Museum (NM) in Prague on 11 March 2023, when anti-government protesters attempted to enter the museum building in order to tear down the Ukrainian flag hoisted to express support and solidarity with the country defending its territorial integrity against the aggressor who attacked them on 24 March 2023. Protesters in Wenceslas Square demanded the resignation of the current government of Czech Prime Minister Fiala due to high inflation and high process of energy and food. They also called for peace negotiations. They carried banners "Stop the war - stop NATO" or "US bases back to the US and there will be no more war", etc. One of the protesters then called to enter (attack) the NM building and remove the Ukrainian flag from its façade. On the other side of the square, a pro-European and pro-Ukrainian demonstration took place. Paradoxical about the whole situation is the high level of aggression among the protesters demanding peace.

A tweet (i.e. a Twitter status) reacting to the political situation is shown in Fig. 11, which shows a mobile LL - a private car serving as signs carrier ("Stop the Ukrainisation of the Czech Republic", "Politicians must not leave the world by natural death", "White lives matter", etc.) and Czech flags. The car as a carrier would deserve a separate analysis in a separate study, not only with regard to the author's phobias (e.g. phobia against

migrants and aid for them), but also death threats (to politicians), etc.



Figure 11 Mobile LL (car)
Source: OstraVanda, Twitter.com (13/3/2023)

With regard to the peace marches in Slovakia and the Czech Republic, the level of interactivity in this direction is considerably high (see Figure 12): 'We also want peace, that is why we support the defence of Ukraine'. We conclude from the above that the main feature of the war landscape is unambiguous value attitudes asserted in a dialogical form often with an emotional charge, and thus not infrequently these are stylistically symptomatic communications (cf. Figs. 5 and 6, Figs. 9 and 10, Fig. 12). The monologic nature of LL (Figs. 1-4, e.g. Havel's statement and truth and love) is disrupted through the active approach of the communicant(s) (Figs. 5, 6, 9, 10, 12) in order to assert his/her/their value-based vision of the world on the pro/con axis (for/against the government, Ukraine, Russia, NATO, the EU, politicians, etc.). There is a clear consensus on peace - but each of the polarised sides interprets peace differently. At least one opinion group sees peace as a capitulation of the UA (or at least an acceptance of the status quo) and another as a capitulation of the RF. Another feature is the intensification of the billboardisation of public space in order to proclaim opinion not only at the top-down level (authorities and elites, e.g., signs/whistleblowers placed on a museum building, official EU billboards, billboards of political parties, activist associations, etc.) but also bottom-up (e.g., a personal car, the space of a private balcony). Urban public space becomes a site of clashes of opinion and values (Fig. 12): a leaflet in the village with the wording "We want peace" prompted a reaction in the form of "We also want peace, therefore we support the defence of Ukraine". In this way, the warlike linguistic landscape or political linguistic landscape moves from the real to the virtual space. A phenomenon occurs in the warscape where is merges with the cyberscape or netscape (cf. Istók - Lőrincz - Tóth. 2022, p. 12), thus reaching a wider spectrum of recipients/interlocutors.



Figure 12 We want peace

Source: *Dárek pro Putina*, Twitter.com (13.3.2023)

5 Conclusions

The dynamics of the LL narrative is influenced by the state of war in the neighbouring country, not only in the static multimodal signs (billboards, buildings, façades) but also in the mobile signs of the LL (car, mobile banners, leaflets, signboards). We observe several basic features of the signs captured in the space of the LL in the Czech and Slovak urban areas, namely: contextual topicality (reaction to the state of war in the neighbouring country from 24/2/2023, resp. 2014 to the present), the shift from monological to dialogical reading resulting in multilayered communication, the billboard of communications, stylistic markedness (or the shift to stylistically coloured communications), the shift to expressiveness and the escalating emotional charge from "we want peace" to death threats (e.g. to politicians). These tendencies are intensifying in view of the pre-election period in the Slovak Republic (the forthcoming autumn parliamentary elections) and possibly in other countries in the run-up to the elections. Thus, the topic of war becomes not only part of the LL (political advertisers and activists expressing clear value positions), but also enters the internal political struggle to win the electorate to their side.

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Primary Paper Section: A

Secondary Paper Section: AI

ACCOUNTING FOR OWN PRODUCTION – DEFINING THE NEGATIVES OF CURRENT CZECH METHODOLOGY

^aKRISTINA KABOURKOVÁ, ^bANNA HODINOVÁ,
^cROBERT KUCHAR

*Institute of Technology and Business in České Budějovice,
School of Expertness and Valuation, Okružní 517/10, České
Budějovice 37001, Czech Republic*
email: ^akabourkova@mail.vstecb.cz, ^bhodinova@mail.vstecb.cz,
^ckuchar@mail.vstecb.cz

Abstract: The paper deals with the analysis of the current methodology of manufacturing accounting in accordance with the Czech accounting standards. For the purposes of the paper, the method of process analysis is used. The paper defines the negatives of accounting procedures that have been used since 2016 and compares the current accounting procedures with the procedures used before 2016. It has been found that the current methodology according to the Czech accounting standards is in conflict with the Act No. 563/1991 Coll., on accounting. According to the former procedures, increase or decrease in manufacturing inventory were accounted for with the accounts in Class 6 – Revenue. Under the current rules, changes in manufacturing inventory are accounted for in the accounts in Class 5 – Costs. This significantly distorts the total value of costs and revenues. The financial statements prepared on the basis of such documents thus do not provide a true and fair view of the subject matter of the accounts, as required by Act No. 563/1991 Coll., on accounting. There is a conflict between the rules laid down by the Czech Accounting standards for manufacturing accounting and the requirements for financial statements under the Act No. 563/1991 Coll., on accounting.

Keywords: accounting for manufacturing inventory, Czech accounting standards, the Accounting Act, costs, revenues

1 Introduction

This paper focuses on manufacturing accounting and defining the negatives of the current applicable Czech methodology. Prompt information about the financial health of a company is provided in balance sheet (Anvarovich, 2020). Balance sheet is a principle to assess the company's property from two perspectives, specific property items (assets) and the origin of the asset (liabilities) (Sroufe & Ramos, 2015). Assets include current assets, where manufacturing inventory represents a significant part. Inventory is intended for sale and include raw materials, work-in-progress (unfinished products), finished goods, purchased goods intended for resale, including e.g., goods purchased by a retailer for resale, land, or other assets intended for resale (Simeon & John, 2018).

According to Singh et al. (2021), the most common types of inventories by stage of processing are raw materials, work-in-process (WIP), and finished products. This classification is based on the location of inventory in various production stages and accentuates the position of inventory in the value chain of the company (Alfares & Ghaitan, 2022). Sroufe & Ramos (2015) add the fourth group to the classification, namely stock of goods, while Himick et al. (2022) supplement the classification of inventory by stage of processing with goods in transit. These can be considered a part of working stock, because even if not available for sale or delivery, they still provide a sense of security. They become available at the moment when arriving from one location to another (Potkány et al., 2022). Manufacturing inventory is included in the current asset, as it is produced by the accounting entity itself. It is valued at own costs or based on production costing in a given accounting entity (Wang & Wan, 2020). According to Verma (2015), inventories also include finished products produced by the accounting entity, work-in-process, material, and similar supplies intended for consumption within the production process. Inventory produced by own economic activity include work-in-process in the form of unfinished and semifinished products, finished products, and animals (Khusinov & Sh, 2021).

The terms work-in-process and semi-finished products are used for the products that have undergone certain production stages but cannot be considered finished products (Zhang et al., 2015). They also include unfinished activities that do not generate material products, such as separately registered products, i.e., semi-finished products that have not undergone all production stages and will be finished or completed by the accounting entity

in the next stage of the production process (Han et al., 2021). According to the aforementioned decree, manufacturing inventory includes also young and other animals as well as their groups. These are young animals, including slaughter animals, which are not reported in adult animals and their groups, in material, or goods (Gottlieb et al., 2022).

Valuation of work-in-process, semi-finished products, or finished products is based on the type of the production process, production time, and the chosen technology (Nisha, 2015). Another factor playing a role is the time of the production cycle, i.e., whether the production time is or is no longer than one year. Information about the status and valuation of manufacturing inventory are obtained from internal accounts. For this reason, accounting standards require the company to provide conclusive documentation from internal accounts (Avi, 2021).

In 2016, there was a major change in the Czech Accounting Standards concerning accounting for manufacturing inventory. Until that year, increase and decrease in manufacturing inventory were accounted for in Class 1 – inventories in Class 6 – Revenues. Since 2016, these changes have been recorded in Class 5 – costs. The change in manufacturing accounting from revenue to cost accounts has been also reflected in the change of profit and loss account (Hašková & Fiala, 2022). The change has also affected the amount of turnover, since the term annual aggregate net turnover refers to the amount of revenue less sales discounts. Therefore, according to the new methodology, manufacturing inventory is no longer a part of net turnover. (Gláserová, 2015).

Manufacturing inventory, costs and revenues are also defined by International Accounting Standards (Napier & Stadler, 2020). These standards resulted from the situation in 1973, when due to the globalization of capital markets, the International Accounting Standards Committee (IASC13) was established by nine countries. Its primary goal was to create and improve harmonization rules and accounting standards, as well as to ensure their worldwide application through the formulation and publishing of accounting standards and rules for reporting for the benefit of the general public (Král, 2014).

According to the International Accounting standards, an expense is the reduction of the economic benefit that occurred during an accounting period in the form of outflows/inflows of assets or an increase in the value of liabilities, which results in the reduction of equity in a way other than distributing the equity to the owners. In the case of expenditures, reporting is conditioned by the timing of the recognition of the decrease in assets or increase in liabilities incurred by the expense (Gheorghe, 2016). It is also important to be able to value the expense. Expense incorporates the concepts of cost arising from ordinary activities and losses. Cost arising from ordinary activities include, e.g., cost of sales, wages, and depreciation. Income includes both revenues and gains (Turgunovich, 2021).

The goal of the paper will be achieved using a process analysis of the accounting for manufacturing inventory currently applicable in the Czech Republic. These procedures will be compared with the procedures valid before the amendment that has been in force since 2016. There will be compared the regulations in force according to the Act No. 563/1991 Coll., on Accounting and Czech accounting standards.

2 Methodology

There will be performed a process analysis of the current methodology of accounting for manufacturing inventory, where the prescribed procedures stipulated in the Czech Accounting Standards according to the Ministry of Finance of the Czech Republic (2023) will be analysed, specifically, the Czech Accounting Standard for Entrepreneurs No. 007 – inventory differences and declines, No. 015 – Inventory, No. 019 – cost and revenues. There will be defined the principles of using

specific accounts in accounting for typical selected economic operations. The output will be the currently applicable account assignment.

These procedures will be compared with the methodology applicable before the year 2016. The output will be the previously valid account assignment of typical selected economic operations. This will be followed by assessment whether the currently valid methodology according to the Czech Accounting Standards is in line with the Act No. 563/1991 Coll., on accounting. It will also be assessed whether the accounting according to the currently valid methodology provides a truer and fair picture of the situation of the accounting entity compared to the situation before the year 2016.

3 Results

Accounting for manufacturing inventory is generally subject to the Act No. 563/1991 Sb., on accounting. The issue is addressed in the Czech Accounting Standard for Entrepreneurs No. 015 – Inventories (the Ministry of Finance of the Czech Republic, 2023).

According to this standard, accounting for manufacturing inventory, which will be valued at own costs, can be performed using the “A” method with the accounts in Class 1 – Inventories with the appropriate account in Account Group 58 – change in manufacturing inventory and capitalization. It is also possible to use the “B” method, where no entries are made in Class 1 during the accounting period and the costs incurred in production are accounted for in the accounts of Class 5 - Costs. When closing the books, the opening balances of these inventories are derecognised, and the inventories identified by stocktaking are then charged to the appropriate account in Group 12 – manufacturing inventory with the appropriate account in Group 58 – Changes in manufacturing inventory and capitalization.

The Czech Accounting Standard for entrepreneurs No. 007 – Inventory discrepancies and natural decline standards stipulates that in the case of inventory discrepancies in manufacturing inventory, these inventory discrepancies within the natural decline standards and surpluses are accounted for with the accounts in Group 58 - Change in manufacturing inventory and capitalisation.

The Czech Accounting Standard for Entrepreneurs no. 019 – Expenses and Income specified that in the accounts in Group 58 – Change in manufacturing inventory and capitalisation shall account for increases and decreases in manufacturing inventory, where the offsetting accounts are the corresponding accounts in Class 1 – Inventories.

Act No. 563/1991 Coll., on Accounting, Section 7 stipulates that accounting entities are obliged to keep accounts in such a way that the financial statements drawn up on their basis are clear and give a true and fair view of the subject matter of the accounts. The provided picture is true only if the contents of the items in the financial statements correspond to the actual situation presented in accordance with accounting methods the accounting entity is obliged to apply under this Act, and is fair, if the accounting methods are applied in a manner that enables achieving true representation.

Tab. 1: Selected accounting operations – accounting for manufacturing inventory according to the current methodology

Economic operation	Account assignment
Production of WIP - method “A”	121/581
Production of semi-finished products – method “A”	122/582
Manufacturing products – method “A”	123/583
Inventory discrepancies within the natural inventory decline standards – finished	583/123

products	
Inventory discrepancies – deficits – finished products	54x/123
Inventory discrepancies – surpluses – finished products	123/583
Loss of WIP during their removal from storage	581/121
Loss of semi-finished products during their removal from storage	582/122
Loss of finished products during their removal from storage	583/123

Source: Authors

Before the year 2016, the Czech Accounting Standard for Entrepreneurs no. 007 – inventory discrepancies and losses within the natural inventory decline standards, specified that in the case of manufacturing inventory, the inventory discrepancies and losses within the natural inventory decline standards were recognised to the relevant account in Account Group 61 – changes in inventory, deficits to the relevant accounts of the Account Group 54 – other operating costs, and surpluses to the relevant accounts in Account Group 61 - Changes in manufacturing inventories.

Before the year 2016, Czech Accounting Standards for Entrepreneurs No. 015 - Inventories specify that increases in manufacturing inventory accounted at own costs as well as changes resulting from the removal of the inventory from stock are accounted for with the relevant accounts in Group 61 – changes in manufacturing inventory.

Before the year 2016, Czech Accounting Standards for Entrepreneurs No. 019 – Expense and Income stipulated that increases and decreases in manufacturing inventory, or changes based on discrepancies identified in stocktaking are accounted for in Accounting Group 61 – changes in manufacturing inventory. Accounting Group 62 – capitalization was used for the production of materials and goods.

Tab. 2: Selected accounting operations – accounting on manufacturing inventory according to the methodology valid until 2016

Economic operation	Account assignment
Production of WIP - method “A”	121/611
Production of semi-finished products – method “A”	122/612
Manufacturing products – method “A”	123/613
Inventory discrepancies within the natural inventory decline standards – finished products	613/123
Inventory discrepancies – deficits – finished products	54x/123
Inventory discrepancies – surpluses – finished products	123/613
Loss of WIP during their removal from storage	611/121
Loss of semi-finished products during their removal from storage	612/122
Loss of finished products during their removal from storage	613/123

Source: Authors

If we agree that costs can be characterised as a monetary consumption of inputs used by an accounting entity for the purpose of generating income (Antle & Bogetoft, 2018), then it is clear that the current methodology of manufacturing accounting contradicts this definition.

Product manufacturing is associated with consumption accounted for in various accounts in Class 5 - Costs. The aggregate amount of costs thus indicates the total sum of inputs in the accounting entity. However, if increases and decreases in WIP are accounted for in accounts in Accounting Group 58—changes in manufacturing inventory, this decreases the total value of costs and breaks the overview of the total costs of an accounting entity. The figure given under item 5 – Costs is thus unrealistic.

If we agree with the definition that costs represent the outputs of economic activities and increase economic profit (Zha Giedt, 2018), then it is evident that the current methodology of accounting for manufacturing inventory also contradicts this definition. If we produce something, then we perform; performance expressed in money is referred to as revenue. According to the current methodology of accounting for VLASTNÍ VÝROBA, accounting entities thus do not actually perform any services, do not have any outputs of from their economic activities. The figure given under item 6 – Income is thus unrealistic as well.

The Act No. 563/1991 Coll., on Accounting, stipulates that financial statement needs to be compiled in a comprehensive manner and shall give a true and fair picture of the subject matter of accounting. This picture is fair if the content of the financial statement items corresponds to the actual state, which is presented in accordance with the accounting methods. It follows from the above that according to the current effective accounting procedures, the individual items of financial statements in the case of manufacturing inventory do not correspond to the actual state, which means that the given picture is not fair and true. Accounting entities are obliged to follow the valid methodology; however, as documented above, this methodology is in conflict with the Accounting Act.

Moreover, this change in the methodology is completely unsystematic. As an example, we can mention accounting for damage. The amount is accounted for as a cost. The request for reimbursement from the insurance company is then recognised in income, as this is the other side. If the current accounting procedures were consistent and systematic, the request for reimbursement from the insurance company would not be recognised as income but it would reduce the overall costs of the given entity.

It shall be noted that Účtová osnova pre podnikateľov 2023 Slovenskej republiky (the Chart of Accounts for Entrepreneurs of the Slovak Republic, 2023) (the Ministry of Finance of the Slovak Republic, 2023) still includes the Accounting Group 61 – changes in organizational inventory and 62 – capitalization. Specifically, this refers to accounts 611 – changes in the status of WIP, 612 – changes in the status of semi-finished products, 613 – changes in the status of finished products, 614 – changes in livestock, 621 – capitalization of material and goods, 622 – capitalization of intra-organizational services, 623 – capitalization of fixed intangible asset, and 624 – capitalization of fixed tangible asset (specific example is mentioned e.g., by Polikarpova & Mizikovskiy, 2018). Slovak accounting experts have undoubtedly concluded that manufacturing accounting in Class 6 – Revenue is methodologically correct. The users of their financial statements are thus able to obtain true and fair data on a given accounting entity in a simple and understandable form.

4 Discussion of results

In terms of current publications but from a historical perspective, the issue of accounting for manufacturing inventory is addressed by Loft (2020), who pays particular attention to a period in the history of accounting and examines the interaction of knowledge, techniques, institutions, and professional demands in Great Britain. Another historical reflection on this issue is

provided by Carvalho et al. (2007), whose research contributes to understanding the historical development of accounting by providing an example of the cost accounting practices in a Portuguese company and analyses the integration of the systems of cost and financial accounting within double entry accounting. The current approach to how to account for manufacturing operations is provided by Schmidt & Nakajima (2013), who use German method developed for material flow cost accounting (MFCA).

The current Czech methodology of manufacturing accounting differs in many aspects from the procedures and practices applied abroad. In the context of accounting for manufacturing inventory, a research question was formulated on whether the current applicable methodology according to the Czech Accounting Standards for manufacturing accounting is in compliance with the Act No. 563/1991 Coll., on accounting. It has been found that the Czech Accounting Standards and the Act No. 563/1991 Coll., on accounting contradict each other in accounting for manufacturing inventory. According to the standards, increases or decreases in manufacturing inventory are accounted for in accounts in Class 1 – Inventory with a corresponding entry in the accounts in Group 58 – change in manufacturing inventory and capitalization. This results in the manipulation with Account Class 5 – Cost. At the same time, production outputs and the increase in economic profit are completely ignored, as the accounts in Class 6 – Revenue are not considered.

The second research question was whether accounting for manufacturing inventory according to the current methodology provides a truer and fairer picture of the situation of a given accounting entity compared to the methodology used before the year 2016. The Act No. 563/1991 Coll., on accounting prescribes that financial accounts based on individual items needs to be compiled in a comprehensive way and shall provide a fair and true picture of the subject matter of the accounts. However, this is in contradiction with the above prescribed procedures. Accounting entities are obliged to follow the Czech Accounting Standards; however, this means that provisions stipulated in Section 7 of the Act No. 563/1991 Coll., on accounting cannot be complied with. The methodology of accounting for manufacturing inventory valid until 2016 undoubtedly guaranteed that the financial statements compiled in accordance with this methodology would provide a true and fair view of the subject matter of the accounts.

In addition to the above, it shall be noted that the new amendment to the methodology increases the compatibility with the International Accounting Standard IAS 2 Inventories, according to which it is necessary to allocate everything, not only the items determined by the accounting entity. The question is how unaudited small and micro accounting entities will be able to handle deciding on the chosen method and including or excluding causally attributable indirect costs (Otavová & Gláserová, 2017). This is because an incorrect valuation of inventories will not only cause an administrative accounting offence but will also have a impact on corporate income tax (Aljinovic Barac et al., 2017).

5 Conclusion

The goal of the paper was to analyse the current methodology on manufacturing accounting and the comparison of the current methodology with the methodology used before the year 2016.

It has been found that the current prescribed accounting practices in manufacturing accounting prescribe to account for increases and decreases in these products incorrectly in Class 5 – Cost. This results in the distortion of the total value of costs. Conversely, these facts are not reflected at all in Class 6 – Revenue, which distorts the overall value of income.

The methodology currently in force is thus in contradiction with the Act No. 563/1991 Coll., on accounting, since the financial statement drawn in accordance with these regulations does not provide a fair and true picture of the subject matter of the accounts.

The methodology valid before the year 2016 concerning accounting for manufacturing inventories stipulated that the increases and decreases in manufacturing inventory were accounted for with the accounts in Class 6 – Revenue. This avoided distortion of the total costs and the actual value of the outputs of an accounting entity was accounted for in revenues, where the increased economic profit of a given company was accounted for. The previous methodology was thus in line with the requirements stipulated in the Accounting Act.

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Primary Paper Section: A

Secondary Paper Section: AH

CONCEPTUAL FRAMEWORK FOR DETERMINING THE TRANSFER PRICE OF THE LOANS

^aDAGMAR KALOVA

*Brno University of Technology, Faculty of Business and Management, Kolejní 2906/4, 612 00 Brno, Czech Republic
email: dagmar.kalova@vut.cz*

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Abstract: Associated enterprises integrated into business groups may use the capital resources of the group. When setting the remuneration for their use, they must ensure that prices between them are set according to the rules of the Organisation for Economic Co-operation and Development (OECD). The core document is the Transfer Pricing Guidance on Financial Transactions. Based on the results of a qualitative analysis (content and contextual analysis of the document), the aim of the article is to systematize the procedures used to determine the transfer price in financial transactions such as loans and borrowings where the parties are related parties (hereinafter referred to as "intra-group loans"). The decision-making process is illustrated by means of a flow chart that establishes the basic decision framework, or the individual steps leading to the selection of an appropriate transfer pricing method for intra-group loans.

Keywords: Cost of debt, credit rating, cup method, debt, economic models, interest rate, transfer price.

1 Introduction

The integration of an enterprise into a business group brings significant competitive advantages. Business groups are better able to cope with the imperfections of the external capital market, which are the limited availability of capital and the high cost of corporate financing (1). Hence, unlike independent enterprises, associated enterprises can share common resources within the group (2, 3, 4), take loans from related parties, take bank loans guaranteed by related parties (3), etc. The sharing of the group's capital resources takes place in the so-called internal capital markets. It is particularly used in situations where external financing is unavailable or involves high costs (5). Associated enterprises can also draw financial guarantees from other group members and more easily raise funds in external capital markets, i.e. from unrelated and independent lenders. Some businesses use internal capital markets to reduce costs, for others it may be a means of raising any funds at all. In all cases, the merged companies have to deal with the issue of setting the interest rate correctly. The Organisation for Economic Co-operation and Development (hereinafter referred to as the "OECD") is also looking into the accuracy of the valuation, with the aim of preventing profit shifting to other countries. The outcome of its work is the Base Erosion and Profit Shifting (hereinafter referred to as the "BEPS") project, which makes recommendations against tax avoidance. In this regard, the OECD has issued guidelines on transfer pricing in debt financing (6). The OECD's initiative contributes not only to avoiding profit outflows to other countries, but also to reducing capital outflows to countries with lower capital taxation (7).

As such, the issue of transfer pricing is regulated by the OECD Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations (hereinafter referred to as the "OECD Transfer Pricing Guidelines") and requires associated enterprises to determine remuneration in accordance with the arm's length principle. The guidelines are the main methodological material for setting transfer pricing (8) and are a comprehensive and globally recognised standard (9). In the case of loans, the arm's length principle is applied to determine the amount of interest, which must correspond to a price agreed between independent parties. The key in this context is the determination of the credit rating. An assessment of the borrower's creditworthiness by an independent lender or rating agency. For some companies, credit ratings are publicly available, but most companies have to carry out multiple assessments to determine or estimate them. The importance of debt financing in the context of the international environment is evidenced by the inclusion of related standards in

the OECD Action Plan against BEPS. This project aims to prevent the shifting of profits to other countries - including in the context of abusive debt financing. Transfer prices, which are used to value transactions between related parties, are an area of tax risk that is subject to tax audits. Through international data exchange, tax administrations can identify risky businesses at minimal cost (10). A proper understanding of the rules contributes to reducing the number of tax disputes and increasing legal certainty in resolving these tax matters (11).

2 Literature review

In some countries, the OECD rules on transfer pricing are directly incorporated into national tax laws. However, this is not the case in the Czech Republic. Here, the statutory regulation of transfer pricing is regulated in only one statutory provision, namely Section 23(7) of Act No. 586/1992 Coll., on Income Taxes, as amended (12, 13). The Czech Tax Administration publishes information on the OECD guidelines, in particular provides their translation into the national language. Basic definitions and concepts on transfer pricing must be sought in European legislation. The main idea of transfer pricing is to negotiate a price between associated enterprises in accordance with the arm's length principle. The price agreed shall not differ from the price agreed between independent enterprises.

In testing whether the arm's length principle has been respected, the nature of the transaction is assessed. A functional analysis is carried out to define the transaction, followed by a comparative analysis. Transactions are of two types, dependent and independent. For a dependent transaction, a comparable transaction is sought. A comparable transaction is a transaction of a similar nature entered into between independent enterprises. The meaning of each definition is as follows (14):

- i. Associated enterprises. Two enterprises shall be deemed to be associated if one of the enterprises of one State participates, directly or indirectly, in the management, control or assets of an enterprise of the other State, or if the same persons participate, directly or indirectly, in the management, control or assets of an enterprise of one State and of an enterprise of the other State.
- ii. Independent enterprises. Neither enterprise participates in the management, control or assets of the other enterprise. The enterprises do not have the same persons in management and control functions.
- iii. Dependent transaction. Transactions between associated enterprises.
- iv. Comparable transaction. There are no significant differences between the dependent and independent transactions or sufficiently precise adjustments can be made to eliminate the effects of such differences.
- v. Functional analysis. The objective is to accurately define the financial transaction, assessing functions and risks. In particular, the creditworthiness of the borrower is assessed.
- vi. Comparative analysis. Comparison of a dependent transaction with an independent transaction. The comparative analysis provides information for selecting an appropriate transfer pricing method (8).

The obligation to determine the arm's length price between related parties generally applies to debt instruments. The definition of debt instruments in the Czech Republic is contained in Act No. 89/2012 Coll., the Civil Code, as amended (hereinafter referred to as the "CCC"). Debt instruments may be a loan, a borrowing, a sale and a credit (15). This article focuses on the most common financial instruments, which are loans and borrowings. Loans are regulated by section 2395 et seq. CCC, the contracting parties are the lender and the borrower, the object is the funds, the remuneration is the interest (9). The loan is regulated in Section 2390 et seq. CCC. The contracting parties are the lender and the borrower, the object is the return of an item of the same kind, and interest may be agreed (9). A loan is a

very common type of transaction between related parties. Determining the normal level of interest is a very challenging task and is the result of a number of related analyses. A key aspect for the valuation of the interest rate between associated enterprises is the determination of the credit rating (6).

2.1. Interest rate and credit rating

The interest rate is determined from the lender's perspective, based on the borrower's credit rating. A borrower's credit rating reflects the likelihood that the borrower will not pay interest or principal when due (16). Currently, banks often use credit ratings from credit rating agencies, either directly or as a benchmarking tool for internal rating models (17). A credit rating reflects the creditworthiness of an enterprise. There are quite a few definitions of the creditworthiness of a borrower (18).

Credit rating tells about an enterprise's ability to obtain credit, and to properly repay it (18). With the growth of financial markets, modeling financial investments is becoming increasingly complex and finding a suitable model for interest rate is the biggest challenge (19). The reputation of credit rating agencies took a hit during the global financial crisis of 2007-2008, when it became clear that credit rating agencies were systematically mispricing risk (20). Moreover, rating SMEs is also a challenge for financial institutions (21). Their regression models used to predict default risk may not work well due to limited or missing data (21). The solution was the development of a long-term rating model by Moody's, but this focuses mainly on industrial and retail companies (22).

The factors determining creditworthiness vary across sectors (23). Researchers can focus on these industries to identify the factors determining their creditworthiness and can explore an exclusive technique for determining the credit rates applicable to the industry (23).

The creditworthiness of the borrower is crucial in determining the credit risk. An important indicator for assessing the creditworthiness of a borrower is the establishment of a credit rating (6). It is the most important factor in lending (16). There are three main rating agencies in the market, namely Moody's, Standard and Poor's and Fitch Ratings (20, 24). Information from public sources, but also obtained non-publicly, is used to determine ratings (22). Artificial intelligence can be used to determine credit ratings, which can work with large amounts of data (22). Moody's scale starts with Aaa (highest rating) and ends with C (worst rating (25, 22). Standard and Poor's uses ratings from AAA to D (25), as does Fitch (24). A limitation is that companies can obtain different ratings. For example, the methodologies of Standard and Poor's and Moody's do not match (25). Comparisons of these methodologies are described in more detail in, for example, Jiang (26), Solilová et al. (24).

3 Research problems and goal

The issue of transfer pricing in financial transactions is described in the OECD Transfer Pricing Guidelines. The document contains instructions and describes the different methods. Specifically, the issue of financial transactions is dealt with in Chapter X entitled Transfer pricing aspects of financial transactions. This chapter is in text form without visualizations. The graphical layout contributes to a clearer understanding of the rules. To date, no specific manual has been issued by the Czech tax administration on these guidelines. The only step was the publication of the Czech translation of the guidelines in February 2020. The issue affects a large number of taxpayers as sharing of capital resources between related parties is a common occurrence. At the same time, it is a complex and complicated subject.

The aim of this paper is to provide a comprehensive framework and to contribute to a better understanding of the rules using visualization of the results. Using a flow chart, the decision-making process is visualized, identifying the steps and procedures that lead to the selection of an appropriate method for

determining the transfer price for intra-group loans. It is therefore also an output with application potential.

4 Methods

Associated enterprises that take out or grant intra-group loans need to look carefully at transfer pricing issues and get the interest rate right. They have to work with a large amount of information, which they obtain using numerous analytical tools. The decision-making process is described in the OECD Transfer Pricing Guidelines in their in sub-provisions, see Table 1. Both the borrower and the creditor involved in the intra-group transaction evaluate the information. As each party has different objectives, their views on the evaluation of the transaction may not be identical. The objective of the lender is to provide financial resources to a borrower who will be able to repay the loan properly and on time. The borrower's objective is to obtain financial resources at the lowest cost. Both parties must be able to prove, in the event of a tax audit, that the interest rate has been determined in accordance with the rules of the OECD Transfer Pricing Guidelines. The correct determination of the interest rate is preceded by the selection of an appropriate valuation method.

Table 1: Assumptions for correct interest valuation

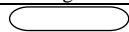




Point	Key provisions
10.51.	The transaction is evaluated from the perspective of the borrower and the lender. Their valuations need not be identical.
10.54.	The lender's objective is to prevent the risk of default on the amount owed. The lender's interest is in proper and timely repayment.
10.58.	The borrower's objective is to obtain credit at the lowest cost.
10.88.	The selection of an appropriate valuation method is a prerequisite.

Source: own elaboration (6)

The paper is designed as exploratory. Its objective is to describe and evaluate procedures to determine the appropriate method for determining the interest rate as a remuneration for the use of intra-group loans. The subject of the research was Chapter X of the OECD Transfer Pricing Guidelines. It was subjected to content and contextual analysis of the text. The paper does not deal with credit default swaps, which are used to value guarantees provided by related parties.

The aim is to graphically capture the decision-making process of selecting an appropriate interest rate valuation method, presenting a tool to better understand the linkages and context. The visualization of the individual steps undoubtedly contributes to a better understanding. The entire decision-making process in determining the interest rate is depicted in the form of a decision tree, which is classified as a flow chart. Decision trees are one of the most intuitive decision-making methods and are widely used in economic practice (27). The advantage of decision trees is the simplicity of their application. They are also clear and easy to understand. Table 2 shows the patterns used. Microsoft Visio software (28) was used to create flowcharts.

Table 2: Figures used

Figure	Meaning
	Beginning and end
	Decision
	Process
	Criterion
	Method

Source: own elaboration

The decision-making process was constructed by identifying individual decision steps, which were then analyzed and evaluated. Based on the analysis of Chapter X of the OECD Transfer Pricing Guidelines, the main criteria were identified and

the solution options were assigned to them. As part of the related evaluation, the problematic aspects that need to be addressed were described in the Discussion and Conclusions section. It should also be taken into account that the determination of the transfer price is a very demanding and holistic discipline, where the taxpayer must take into account not only macroeconomic factors, but also the situation in the borrower's business sector, the results of competitive analysis and the analysis of the companies participating in the transaction. In this respect, then, the output below is seen as an important, albeit still partial, input to the decision-making process.

5 Results

A priority issue that both the borrower and the lender must address is whether the intra-group loan is correctly classified. This is the subject of the functional analysis. It assesses whether the borrower is exposed to the risk of default and penalties for late payment. In particular, in situations where it is clear that the borrower will not be able to repay the funds raised, the resources should not be classified as a loan. The funds provided should be in the nature of an additional contribution to strengthen the equity of the enterprise (6, point 10.5). The debt capacity of an enterprise can be measured by the size of fixed assets (asset tangibility) and the financial capabilities of the enterprise (financial constraints) (29). Unused debt capacity is a reflection of the financial flexibility of the enterprise and enables the enterprise to obtain external sources of financing (30). In case the debt capacity is sufficient, external sources of financing are preferred (31), which are mainly loans.

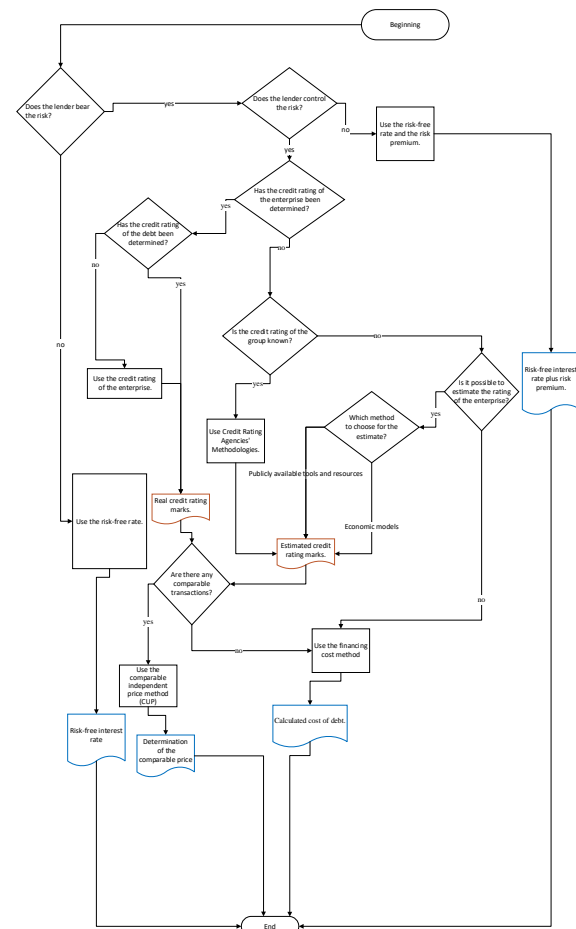
If the financing transaction is correctly classified as intragroup debt, the process of selecting an appropriate method for interest rate valuation can be proceeded with. This process consists of two steps. First, a functional analysis is carried out to define the financial transaction and clarify the contractual terms (6, point B.3.2.). At this stage, the borrower's situation is assessed, in particular its creditworthiness. In the next step, a benchmarking analysis is carried out (6, point 10.20.), which aims at finding a comparable financial transaction between independent entities. An analysis of the financial markets is carried out, in particular assessing the interest rates set for borrowers with different credit ratings. The sub-stages of the decision process are described in Table 3 and illustrated in Figure 1.

Table 3: Factors determining the choice of method

Point	Key factors
1.108.	Does the lender bear and control the risk?
10.71.	Has the credit rating of the enterprise been determined?
10.70.	Has the credit rating of the debt been determined?
10.82.	Is the credit rating of the group known?
10.97.	Is it possible to estimate the rating of the enterprise?
10.72.	Will publicly available financial tools be used to calculate credit ratings?
10.104.	Will economic models be used to value credit?
10.97.	Are there comparable transactions?
10.89.	Can the CUP method be used?
10.97.	Is it possible to estimate the cost of financing?
10.98.	Are the financing costs reasonable?

Source: own elaboration (6)

Figure 1: Decision-making flow chart



In determining the transfer price, the associated enterprise evaluates the circumstances listed in Table 3. The individual factors are evaluated in order:

- i. Does the lender bear and control the risk? If the lender does not bear and control the risk, it is entitled to an interest rate at the risk-free rate (6, point 1.108.).
- ii. Has the credit rating of the enterprise been determined? This rating is indicative of the creditworthiness of the enterprise, the independent perception of the enterprise's creditworthiness (6, point 10.71.).
- iii. Has a debt issue rating been established? If there is both an enterprise issue rating and a debt issue rating, it is preferable to choose a debt issue rating that takes into account the specific features of the debt (6, point 10.70.).
- iv. Has the group's credit rating been established? A group credit rating may be used if the creditworthiness of the enterprise does not differ from the creditworthiness of the group. It can also be used to derive the credit rating of the enterprise, provided that the rating agency process (6, point 10.82.) is repeated.
- v. Is it possible to estimate the credit rating of an enterprise? If it is not possible to estimate the rating of the enterprise, the transfer price must be derived on the basis of the lender's financing costs (6, point 10.97.).
- vi. Which method to choose for the estimate? A variety of economic models and publicly available tools can be used (6, points 10.72. and 10.104.).
- vii. Are there comparable transactions? If there is a comparable transaction, the most appropriate method for determining the price is the comparable arm's length price method, known as CUP (6, point 10.89.). If there are no comparable transactions, the cost can be determined at the level of the cost of financing (6, point 10.97.).

- viii. Are the borrower's financial costs the same or lower than those of other lenders? The financing costs of a lender cannot be claimed at any amount. Account must be taken of the fact that lenders seek to secure the cheapest method of financing in a competitive market (6, point 10.98.).

A key determinant of the interest rate is whether a credit rating has been established for the borrower. This is an indicator that is the result of an assessment of not only quantitative but also qualitative indicators. Most often the credit rating is determined at the level of the business group or not at all. If the credit rating is determined at group level, the credit rating of the enterprise can be derived from it (6, point 10.82.). In this case, the effect of the enterprise's group membership is assessed and the implicit support provided is evaluated (6, point 10.78.). If the credit rating of the enterprise is not established and the credit rating of the group cannot be used, the credit rating can be established on the basis of publicly available instruments (6, point 10.72.). However, if a method other than those used by credit rating agencies is used to estimate the rating, the enterprise must be able to demonstrate to the tax authorities that it has estimated the credit rating correctly.

In summary, the following types of credit ratings can be distinguished:

- i. Issue credit rating, which is an opinion on the creditworthiness of the borrower (issuer) with respect to a particular debt. It takes into account its specific features such as collateral, security and seniority level.
- ii. Enterprise credit rating, which is an opinion on the creditworthiness of the borrower. If the borrower has a publicly available credit rating published by an independent credit rating agency, this rating may be informative for the analysis of the arm's length principle.
- iii. Group credit rating, which assesses the creditworthiness of the business group. A borrower may have a better creditworthiness due to its affiliation with a business group.

Table 4 describes the key provisions for determining credit ratings and the role of multinational enterprises (hereinafter referred to as the "MNE").

Table 4: Credit rating

Arrangements	Type of rating
C.1.1.2.1.	Credit rating of the enterprise (The credit rating of an MNE)
C.1.1.2.2.	Issue credit rating (The credit rating of a specific debt issuance)
C.1.1.2.3.	Group credit rating (The credit rating of an MNE group)

Source: own elaboration (6)

If the credit rating of the enterprise is known or estimated, the comparable independent price (CUP) method is recommended, with a preference for an internal CUP if available. However, if there is no comparable transaction, the borrower must determine the cost of financing in order to value the interest rate. If no risk is assumed, the interest rate shall be set at the risk-free rate. The risk-free interest rate is also used when the lender takes the risk but does not control it. In this case, various rewards are added to the risk-free rate as risk premiums. The methods are described in more detail in the OECD Transfer Pricing Guidelines, see Table 5.

Table 5: Valuation methods.

Arrangements	Method
C.1.2.1.	CUP method (Comparable uncontrolled price method)
C.1.2.3.	Financing costs (Cost of funds)
F.1.	Risk-free interest rate
F.2.	Risk-free interest rate plus risk premium

Source: own elaboration (6)

5.1 Risk-free interest rate

If the lender does not bear or control the risks associated with the granting of the loan or borrowing, the interest rate is set at the

risk-free rate of return (6, point 1.108.). This is a hypothetical indicator as there is no zero-risk investment (6, point 1.109.). The risk-free interest rate is an important economic variable that reflects the time value of money for risk-free assets (32). In this respect, the risk-free interest rate can be used to value the returns on investments with low default risk (6, point 1.110.). To determine the risk-free interest rate, a security should be chosen that was issued by the government in the same period, in the same currency, with the same maturity as the financial transaction being executed (6, point 1.111.). The risk-free rate of return can be considered the rate of return on government bonds (24). The risk-free rate of return can also be determined in other ways, e.g. according to interbank rates, interest rate swap rates, etc. (6, point 1.115.). The disadvantage of using the risk-free interest rate is that it is affected by financial crises (33).

5.2 Risk-free interest rate plus risk premium

The interest rate is made up of two components. The first component is the amount of the risk-free interest rate and the second is the rewards associated with the granting of the loan (6, point 10.96.). Various methods can be used. The most commonly used are the risk-free interest rate and the risk premium (33). Other methods related to the rate of return on alternative comparable investments, the cost of capital, etc. can also be used. The risk premium can also be determined based on the rating of the enterprise. If the rating of an enterprise is not determined, various economic models can be used. In this case, the interest rate is set at the risk-free rate and includes a number of rewards: default risk, liquidity risk, expected inflation risk, etc. (6, point 10.105.). The problem is that the results of economic models do not represent real financial transactions. The OECD Transfer Pricing Guidelines accept that these models can be used, but adjustments need to be made for comparability.

5.3 Financing costs

Financing costs include the lender's borrowing costs, the costs associated with servicing the loan, risk premium fees and a profit margin that includes the lender's incremental cost of the equity required to support the loan (6, point 10.97.). The most challenging task is to determine the cost of equity (24).

A lender must compare its cost of a financial transaction with the cost of other lenders. Consideration must be given to the fact that the borrower would act rationally and would not choose the more expensive financing (6, point 10.99.). The lender must minimize the cost of financing. If there is a competitor in the market that can provide the funds more cheaply, the lender cannot claim higher reimbursement (6, point 10.98.). The disadvantage of financing costs is that this only sets an upper bound on the interest rate valuation (33).

5.4 Comparable Independent Price (CUP)

The comparable arm's length price (CUP) method is a transfer pricing method that compares the price of a dependent transaction with the price of a comparable arm's length transaction conducted under comparable conditions (14). This method is most commonly used (24, 33). The basic assumptions are that i) the credit rating of the borrower or the rating of the issue is established or estimated, ii) comparable entities exist, and iii) comparable transactions can be found. To determine comparable transactions, not only prices but also other pricing terms provided by related parties must be considered in a manner similar to independent parties (34). The method is well suited to the existence of a sufficiently large financial market, the frequency of transactions and the availability of information. Information on the characteristics of individual loans with respect to the credit rating of the borrower or the credit rating of the issue can be retrieved. Lenders must take into account factors that reduce or increase risks (6, point 10.90.). The risk is mitigated by the guarantees and findings provided. The risk increases with the riskiness of the project, longer maturity, lack of collateral, etc. The OECD Transfer Pricing Guidelines accept that there may be a spread of market rates for a given financial

transaction (6, point 10.91.). To determine the market rate, the currency of the transaction, maturity, etc. must be taken into account. The comparable transaction should not be linked only to the borrower's business. A borrower that is a member of a group should be compared with other borrowers that are also members of the group.

The comparable price need not be determined solely by the credit rating of the enterprise, but may also be based on the return on alternative comparable investments. It may also use internal methods of determining a comparable independent price that are based on analysis of internal data. Internal methods are used when the loan is granted by a third independent party (33), i.e. different from the borrower and the lender. The advantage is that the method is easy to use when a comparable transaction between independent lenders is known (33).

The disadvantage of the comparable arm's length price (CUP) method is that it relies on the valuation of a comparable entity for which all information may not be publicly known (24). Also, the question of using the results of the benchmarking analysis based on annual reports is debatable (35). This is because the lack of uniform legislation across different countries may affect the selection of comparable data in the comparative analysis (35).

5.5 Internal comparable price, bank offer, expert's report

Enterprises that undertake both comparable dependent and independent transactions may use internal comparable prices (36). However, this price cannot be applied to financial transactions, due to the fact that financial transactions assess the riskiness of a particular borrower. It is also not possible to use the Valuation Law (37) and the banks' opinion (6, points 10.107. and 10.108.) to price interest.

6 Discussion and Conclusion

The funds provided by the related party may take the form of a capital surcharge or a debt instrument. A basic prerequisite for the valuation of interest is the correct classification of the financial transaction. If the loan is correctly classified, it is possible to proceed to the selection of an appropriate method for valuing the interest. The valuation methods are i) the CUP method, ii) cost of funding valuation, iii) risk-free interest rate valuation and iv) risk-free interest rate plus risk premium valuation. The key is to determine whether the enterprise has a credit rating determined by an independent entity.

There are different methods of assessing the creditworthiness of a borrower. First of all, they are based on the evaluation of selected financial ratios, which are assigned weights of their significance (18). Many commercial banks use complex methods to assess the creditworthiness of borrowers (18). According to Verster et al. (17), banks take into account other parameters besides credit ratings when determining credit risk, such as their internal risk attitude, their internal corporate data, etc.

The OECD's established standard requires associated enterprises to follow a similar approach in estimating credit ratings and to conduct multi-factor analyses. However, credit specialists' decisions are often based on their intuition and experience (18) and are burdened with subjective assessments. The OECD Transfer Pricing Guidelines do not take this into account in the context of the rules for estimating credit ratings.

Enterprises face a number of challenges when estimating a corporate credit rating. Rating agencies work mostly with data from companies in relatively large economies and do not take into account conditions in the Czech Republic (24). Enterprises do not have a sufficient data base. A solution for the future and a challenge could be the creation of a suitable database or a more detailed guide (methodology) for determining the interest rate for selected basic types of transactions (e.g. the creation of a safe harbour).

Some authors point out that CRA ratings should not be considered accurate. They are opinions about the riskiness of entities (17, 22) and do not serve to predict gains and losses (22).

For many enterprises, determining credit ratings is a complicated task. There are many definitions and actual methods to determine credit rating. The rating process involves a number of sub-processes, evaluating multi-factor analyses (e.g. enterprise, group, industry), making comparisons with other companies, etc. However, ratings are normally set by major financial institutions or rating agencies that have in-house data and their staff has expertise. Valuation should be carried out by experts. Enterprises that are financially strong enough can outsource these services or hire qualified staff. For other enterprises, rating will be a costly affair. It would therefore be advisable, especially for smaller enterprises, to set simplified rules, so-called safe harbours. This institute is not established in the Czech Republic. Iřtok et al. (38) identified twelve countries that use simplification of rules in this respect and derived rules for its creation. The author of the article believes that for certain defined standard types of transactions, which will not be burdened with certain specifics (existence of an international element, absence of guarantees, etc.), the instrument would be suitable for the Czech Republic. Setting simplified rules that would be accepted by the tax administration would (i) reduce costs for enterprises themselves, (ii) increase legal certainty in tax administration and (iii) simplify the implementation of tax audits.

The issue of the valuation of financial transactions is a complex one and the rules introduced so far are very general. The OECD itself has published discussion drafts on the issue. The proposals set out different approaches and suggestions for solutions. All this suggests that there is a need to seek simplification, introduce methodological tools and provide guidance to businesses. This article, which focuses on a selected area, contributes to the above by presenting a guidance tool for selecting an appropriate interest valuation method and highlighting problematic aspects.

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NEW TENDENCIES IN THE FORMATION OF THE HISTORICAL PROSE IN THE SECOND HALF OF XX AND AT THE BEGINNING OF XXI CENTURIES [BASED ON THE MATERIAL OF THE ANALYSIS OF CH. HUSEINOV'S THE NOVEL "MOHAMMED, MAMED, MAMISH"]

*KASIMOVA MAYA MEHTIYEVNA

^a*Baku Slavic University, Suleyman Rustam street, 33, Baku, Azerbaijan*
email: "kasimova.maya@yandex.ru"

Abstract: In this study, the specifics of the issue of a national nature are determined. The novel *Mahomet, Mamed and Memish* by the famous Azerbaijani master of words, world-famous writer Chingiz Huseynov is subject to literary analysis. The works also note that in the literary process of the second half of the XX and the beginning of the XXI centuries, the prose of Kamal Abdulla and Chingiz Huseynov appeared, which are currently vivid examples of the postmodern historical process in modern Azerbaijani literature written in Russian. The study pays special attention to issues closely related to corruption and active opposition in the person of the hero of the novel *Memish*, who came to the capital of Azerbaijan, Baku, to his mother to live there, in the house of his uncle Gulbala Bakhtiyarov. Events closely related to his life are revealed against the background of the mentality and lifestyle of the family and national relations.

Keywords: tendency, specificity, national type of character, Azerbaijani literature, artistic images, genre and associative style, mythologism

1 Introduction

Post-soviet historical prose of the second half of XX and beginning of XXI centuries, based on the systematic character creative traditions and cultural interrelations of the multinational writers in the genre of historical prose wholly presented the sum of separately taken national literatures existing within one and the same state. And their active interrelation was based on the principle ideological and artistic community. Connected with the political period of thaw, beginning from the sixties of XX century, the historical prose of Azerbaijan began to experience overestimation of moral and spiritual values in connection with the collapse of a whole state, which never seemed to be shakable.

The article discloses the specificity of the specificity of the problem of the national character by basing of the material of the analysis of Ch. H. Huseinov's novel titled "Mahammad, Mamed and Memish". It also mentions that in the literary process of the second half of XX and the beginning of XXI centuries there appeared the proses of K. Abdulla and Ch. Huseinov, which at present are striking examples of the post-modernistic historical proses in the modern Azerbaijani literature written in Russian.

The purpose of the article is to analyze the artistic trends of the late 50s – early 70s of the twentieth century in the prose of Russian and Russian-speaking Azerbaijani writers from the point of view of their representation of the national and international type of hero who replaced the national hero in connection with the extinction of the literature of socialist realism.

2 Analysis of artistic trends of the late 50s – early 70s of the XX century

The birth of new genres and stylistic tendencies in the creative activity of the Russian-speaking Azerbaijani writers in the second half of XX and beginning of XXI centuries conditioned the birth of socio-cultural determination of historic narration in traditions and customs of multinational writers. In the first stage of their creative searches they relied on the evolution of national and international the problems, which we designated with the term of "modification". Theoretical investigation in the problems of genre and style in the novels of the Russian and Russian speaking Azerbaijani writers at first reflected the events by basing on the canons of the soviet ideology, in the frames of the methodology of socialist realism. But the changes, which were connected with the peculiarities of genre and style of different epochs and national literatures in the liner and multi-liner historical narration, which vividly found their reflections in

the novels of two Russian-speaking Azerbaijani writers, who are Ch. Huseinov, who is fluent in Russian, Azerbaijani, even in Georgian, and K. Abdulla.

In the process of creation of the post-soviet Azerbaijani literature in the second half of XX century and the beginning of XXI century every creative direction in literature usually correlates with the genres of literature, with its different types and modifications. Namely, genre exerts changes in the content and form, because it is a historically formed type of combination of thematic, compositional and stylistic principles, which create an aesthetic whole. Relying on the genre and stylistic system created by the writers themselves enable the investigators and critics expose the novelties in their creative positions. Ch. Huseinov was the first to create the first examples of historical novel titled *Fatal Fatali* and *Mohamed, Mamed, Mamish*. The second was K. Abdulla, who created *The Unfinished Manuscript*, it was the first example of historical novel based on the epos of *The Book of My Grandfather Korkut*. N. Rasul-zade (in his novel "Xonxari") and Y. Samedoglu laid the foundation of a new type of historical novel in the literary process in the second half of XX and beginning of XXI centuries.

Active development of the genre of historical prose was conditioned in the second half of XX and the beginning of XXI centuries by the process of activation of public self-consciousness after "the thaw since the second half of the 1950s and 1960s inherent to the literatures of all national republics. From the study of formation of the genre of historical prose it is known to us that its successful development slowed a little at the end of the 40s. The process of the qualitative renewal of the historical Romance philology characteristic for multinational literatures started in the 60s. According to A. Chakovsky in 1976 a historic-artistic explosion took place. There appeared a type of fiction, which witnessed a total deepening in historicism in the development of historico-artistic prose. Formation of creative conceptions in the organization of the renewal genre-stylistic tendencies, as we think, in this period of time it began to be conducive to the process of modification of the problem of national and international on the basis of the material of the genre of modern and historical prose. In these years the tendency created by the Russian and Russian-speaking Azerbaijani writers was closely "connected with the creative searches and achievements of the writers of other peoples" (Сафаров 1989, 3).

The Russian and the Russian-speaking writers began to include the features of their own national and international peculiarities into the plots of their fictions mainly in the second half of XX and beginning of XXI centuries. In the genre and stylistic formation of the historical narration the writers began the comprehension of the events of history and contemporaneity in the process of reproduction of national and international traits of the character of a contemporary hero possessing the thinking and the world outlook of the writers. It was important to understand the causes and understand the laws of the birth of new aspects of genre and style in the post-soviet literature. With the purpose of confirmation of the truthfulness of the proposed thesis we appealed to the analysis of the figurative material of the novels of Ch. Huseinov and K. Abdulla.

Creating the traits of national and international type of character in the genre of the historical novel at the end of the 70s and beginning of the 80s of XX century, they already do not simply study the historical facts and their numerous documents and evidences of the contemporaries of the historical epoch, but they themselves become pathfinders of the history, by resorting to the exposure of different layers of provisional layers of time on any thematic plane. In the prose of the Russian speaking Azerbaijani writers as Ch. Huseinov, N. Rasul-zade, K. Abdulla, Y. Samedoglu, R. and M. Ibrahimbeyovs, Anar, A. Solzhenitsyna,

B. Shukshin, Y. Trifonov, B. Astafyev, B. Rasputin, B. Makanin, S. Borodin, who created in the post-soviet period of XX century, in connection with the intensive enrichment of the plot of the modern and historic narration, traditions and customs of multinational peoples there emerged new qualities and traits in the typology of national and international types of characters. They witnessed, as we think, the deep interest of the writers in the events of their country and nation.

The active work of a number of scholars witnessed the existence of different views in the study of the literary criticism in Azerbaijan. They confirmed that only in the 70s, when the historical prose got strengthened in new positions in the exposure of social-psychological qualities of the hero, it was a new stage in the development of historical prose. Relying on the principle of typological comparison of a number of opinions on this issue led to contradictory views. So that in particular the popular Azerbaijani literary critic A. Jahangir began to confirm that the development of historical prose only of the 1990s" may be characterized as a period of internal preparation for a new stage" (Джангир 2006). His opinion is refuted by another Azerbaijani critic by name of V. Yusifli, who declared concretely that "the 90s did not create a special stage in the development of the form of novel. There took place only interesting "experiments". In such a case what can we answer to the popular literary critics, by basing on the analyses of historical novels of the Russian and Azerbaijani writers like Ch. Huseinov, N. Rasul-zade, Y. Samedoglu, K. Abdulla, who have created splendid examples of historical novels already at the beginning of the 60s-70s of XX century?

The contents of those historical works contain information on the fates of ancestors, on their wisdom, on the historical experience of the people obtained at the expense of their bloods, deprivations and sufferings in the process of heroic struggles for the freedom and independence, which became the objects of description of the Russian and Azerbaijani writers. They write that an ordinary event, as a rule, emerges and develops in the form of a chain following each other as independent events resting upon different types of plots connected with purely external ties. The Azerbaijani scholar A. A. Mammadov analyzes A. Nijat's novel *Life, which became a Novel*, fights for the necessity of leaving the boundaries of known facts found in documents (Мамедов 1989, 122) and confirms that namely this moment allows disclose the internal world of the national consciousness of the historical figure, when it is based on the national world outlook and manner of the thinking.

Once in their articles the Azerbaijani scholars and literary critics (B. Guliyev, Y. Samedoglu and A. Mammadova) focused attention on the national and international problems and noted that a great number of the Azerbaijani writers appealed to the genre of historical novel. But the quality of reproduction of historical events and the methodology of reproduction, which they used for the creation of the images of historical Azerbaijani heroes like Babek, Shah Ismail, Khatai, and Mirza Shafi Vazeh and their personalities were "pushed to the background and it overshadowed their unique individuality and humane qualities" (Мамедов 1989, 122).

On the background of the statement of humanistic and aesthetic conception of the type of character and in connection with the manifestation of historical narration in the plot of a new type of conflict, the fiction of the Russian and Russian-speaking Azerbaijani writers began to favour the description of historically established typology of structural elements in the form of narration of the content. The common character of traditions of the Russian and Azerbaijani writers in the genre of historical novel demanded from them possession of new problems and themes in order to create new types of heroes which allow them possession of new problems and themes for the creation of a new type of hero on condition that they include new expressive means into the canvas of the fiction, which we think that they are full value recreation of the modern Russian and Azerbaijani historical reality. In the reproduction of one of the stable categories of *Poetics* of Aristotle, called a literary

character, an enrichment of the compositional and stylistic structure of narration took place there.

The plots of works of a number of the Russian and Russian-speaking Azerbaijani writers on the topic of history on the self-consciousness of the peoples in original national forms, in which the authors began to look over "the confusion of time" on the account of such compositional devices as a conditional form of narration, parodying, satirical mockery, the scale of mentioned problems, the variant of unnoticed presence of the person of the author. They led to concentration and dynamism of multi-liner and single liner historical narration, which enabled to the exposure of the active opposition of stagnant phenomena in the Russian and Azerbaijani societies. On the background of new aesthetic functions, which emerge as a result of evolutions in the genre and stylistic structures of historical prose while disclosing the critical state of the society, which leads the contemporary hero to his spiritual degradation, but not consented with the higher instances, which are Ch. Huseinov's novels of "Magomed, Mamed, Memish" and *The Family Secrets* and Y. Samedoglu's *The Day of Execution*.

An active development of the genre of historical prose in the period after "the thaw" began in the second half of 1950s and mids of 1960s, which witnessed the publication of P. Makulu's novel *Sattar khan*, Q. Musayev's novel *The Northern Wind* (for which the author got the state award named after M. F. Akhundov), I. Shikhli's *The Violent River Kura*, M. Ibrahimov's novel *The New Times (Pervane)*. According to N.M. Shedrina (author of the dissertation on the topic of *Historical novel in the Russian literature in the last thirty years of XX century: The road of development not once An active development of the historical novel took place in the last thirty years of XX century*. According to the opinion of the future doctor of philological sciences, it was connected with the public necessity of comprehension of the real, genuine Russian historical prose, she noted that in the seventies the writers, who had not worked in this field like V. Shukshin, Y. Trifonov, V. Chivilikhin, and B. Okujava and others appeared in this field. In the 80s A. Ananyev, V. Ganichev, V. Lichutin and others also became recognized there. It gave a strong impulse to strengthening of the formation of genre and stylistic dominants of the historical novel (Гейбуллаева 2000).

Relying on a number of historical realities Doctor of Philology, Professor R.M.Geybullayeva in her monograph titled *Comparative typology of prose and the literary types* noted that each example of the multi-national literature leaves its imprint on the processes of culture and on its peculiarities. The peculiarities of the Azerbaijani literature, which once represented "a part of the Soviet and united world culture (diachronic – a part of the Iranian, genetically a part of the Turkic literature" (Гейбуллаева 2000, 236). She confirmed that "this piece of literature remains as a bearer of the previous socio-cultural space - pre-Islamic, Islamic, Moslem, soviet, but in it there are inclinations of new culturological system, which opens new pages in the history of Azerbaijani statehood and literature" (Гейбуллаева 2000, 217). Historically appearing in the zone of influence of the Moslem culture, the Azerbaijani culture, sharing common literary traditions with the Russian and multinational literature, images, types different from the tendencies of these literatures and being the product of its own epoch, as in the world and in national and international scale.

3 The evolution of the problem, designated by the term "modification"

In the literary process of the Azerbaijani prose, beginning since the second half of XX and beginning of XXI centuries the genre of the historical prose, stories and novels began to obtain the signs of novels in connection with such a fact that the Russian speaking Azerbaijani writers, including Ch. Huseinov and K. Abdulla assimilated the traditions of post modernism, which allowed the expression of new spheres of life with the aim of possession of problematics in the search of expressive opportunities for the creation full-value fiction. In the renewal of

typological properties in poetics of their fiction, the outdated tendencies, inherent multinational prose of the first half of XX century, which determined the problematics, thematics in the genre of historical novel and genre-stylistic idiosyncrasies in their creative activities underwent considerable changes. It is necessary to note that already in the early stages of their creative activities Ch. Huseinov and K. Abdulla began to appeal to the interpretation of the national mentality and mode of life of the Azerbaijani hero by taking into account the evolution of problem of national and international. The term “*modification*” which we use, is connected first of all with collapse of the USSR and together with it the loss of the communist ideology. It is important to note that as a result of interaction of multinational literatures, which played a certain role in each stage of the modification of the problem, conditioned by economic and socio-political events, which have an impact on the lives heroes, who are his or her contemporaries, inapplicable formed new traits and qualities of national and international type of the character. What in its turn, we think, became the basis, which confirmed the novelty of traditions of Ch. Huseinov and K. Abdulla in the genre and stylistic structure of the Azerbaijani historical novel, allowing the investigators appreciate their creative activity, the valuable artistic creeds coined by them, allowing them fill it with spiritual values inherent to the heroes-contemporaries.

Disclosing the complicated axiology of the national type of the character of the Azerbaijani characters of the works of K. Abdulla *Unfinished Manuscript* and historical novel *Mohammed, Mamed and Memish* began to witness the formation of a new stage in the interpretation of artistic peculiarities of the genre and stylistic structure of the modern historical Azerbaijani novel. We note that in the individual disclosure of “*the artistic map of the world*” there happened the rapprochement of their ideological-artistic system with genetically close real map of the world, nation and mankind. In connection with that it is necessary to say that the historical-genetic approach of the writers include not only the manifestation of the concept of the man, society, existence, but also the deep (archetypical) imagination about the world, in the poetics of their creative activity there took place the formation of some genetic relation and mentality of the external and internal existence of the hero-contemporary. Relying on the aspects of modification of the problem, which is inseparable relation with the epic folklore traditions in the semantic of understanding of “*the map of the world*”, created by them the principles of a new artistic construction of historical narration. In the plots of the Russian speaking Azerbaijani writers they fixed their authorship attitudes, in which there emerged a close correlation of their creative tasks with common popular tasks. Their novelty in the reflection of serious changes in the life of the Azerbaijani and Russian societies finally brought to the creation of new postmodernist model of thinking.

Comprehension of the aesthetic position of K. Abdullayev by the literary critics and scholars of literature in the exposure of national problems in his novel “*The Unfinished Manuscript*” enabled to have a basis to regard the created works based on the epos of the Turkic peoples *The Book of My Grandfather Gorgut*, with a post-modernist plot is still a rare example for the imitation. In compliance with the aesthetics of post modernism the events in it were disclosed not in chronological succession, but in the frames of a condensed, chaotic time, inherent to the traditions of post modernistic direction. Composition of *The Unfinished Manuscript* includes three temporary pieces not depending on each other from the point of view of time; one of them is connected with the epoch of Dede Gorgud and the Sefevid ruler Shah Ismail Khatai, which was disclosed in extracts as legends about the Shah, which is of an episodic character.

In connection with the publication of this work the literary critics and the investigators of the creative activity of K. Abdulla began to speak about the birth of the post modernistic direction in the Azerbaijani prose. Its confirmation was the 1990s. “*By basing on the said there was all proofs to speak about a definite system of artistic thinking as summing up fresh energy in the direction of*

literature with all its stylistic and genre preferences” (Лейдерман, Липовецкий 2003). Based on the ancient Turkic ethnic stories and legends about Dede Korkud his *Unpublished Manuscript* provoked negative (Niyazi Mehdi called this novel *an artistic bluff*) as well as a positive estimation. The critics of the Azerbaijani literature regarded that in the plot of his works there was a doubtful interpretation of legalized rules and canons of the folk epos. The number of novelties in the traditions and in the figurative material of the novel, which consist of an artistic generalization and details inherent to the level of a great pen man, for the estimation of the creative activities of the Russian speaking Azerbaijani writers are closely connected with the reflection of the objective relations and laws of the surrounding reality becoming a true reflection of events and phenomena of history of the measure of artistic truthfulness.

The writer Ch. Huseinov, who is fluent in Russian, Azerbaijani and even in Georgian, and appeared for the first time in fiction at the beginning of the 60s with his first story titled *My Sister* (1961). But At the beginning of the 60s of XX century was already popular as mater of short stories (*The Dark Wall*) and his first big story *Gold*. Further, in his fiction the literary critics and investigators began to look for the reflection of the spirit of epoch in the interrelations of man and society, which was closely connected with the topic of friendly association of people from the same area, speaking the thieves’ cant, protectionism, corruption reigning in the society in Azerbaijan. Then Ch. Huseinov devoted all his life and creative activity to the exposure of the manner of life, mentality of the Azerbaijani nation and the complicated axiology of the Azerbaijani national type of character. We think that all his novels *Mahomet, Mamed Mamish, The Fatal Fatali*, which were created in the 70s-80s of XX century, revealed two approaches of the writer to the reflection of the spirit of the epoch. The first one was based on the internal laws of the construction of his prose. It demonstrated the novelty of the genre and style of his creative activity. In the second approach we see clearly the writer’s interest in the reflection of the thoughts of his heroes and characters from the point of view of appealing to the models of real, conditional and to more abstract level of construction of the type of character.

According to G. I. Lomidze, investigator “*of national and international problems, the new searches of the writers in the genre of historical prose were noticed particularly in the projection of the great fifty-years old historical road of our soviet society*” (Ломидзе, 1968, 6). When the Ch. Huseinov’s prose is analyzed, the scholars usually focus attention on the close relationships of the writer with the analysis of the very morbid problems of contemporaneity. Relying on the reflection of social-psychological foundations of the life of man the writer challenged a complex systemic-analytical study of specific peculiarities of his historical novels (S. Asadullaev, S. Chuprina, P. Ulyashova, V. Kolmanovskiy, A. Marchenko, S. Andreyeva, K. Sultanova, E. Shafranskaya, N.M. Shadrina,, etc.); to represent the full number it is necessary to mention a number of other dissertations: I. F. Farxatova *Character and conflict in the novels of Ch. Huseinov* (1994), M. K. Imanov *Psychologism in the modern contemporary prose of Azerbaijan (1960-1980)*, E. S. Babaeva *Genre-stylistic idiosyncrasy of the novels of Ch. G. Huseinov Mahomet, Mamed Mamish, The Family Secrets* (2007) and others began in the 70ies of XX century.

4 Transformation of the national character and its modification in the 2 halves of the XX – beginning of the XXI century

According to a number of investigators his creative activity as his prose is basically are experimental. One may see in them cinematographic principles of composition in the narration, dialogic monologue and elements of symbolism, used in nonlinear and multiline plot. We do not think that unlike a number of investigators his narrationin principle is based on “florid” irony, which in general is not visible, “hidden” in the text, but only the signal wandering lights designate the direction of the writer’s narration-reasoning. And it means that in the comprehension and description of the reality of Azerbaijan, its

contradictions and conflicts from the point of view of repudiation from the manner of narration in traditional epic constructions, which are characteristic for the genre of historical fiction of the writers of the first half of XX century (A. Tolstoy), the writer followed his own road of creative activity. In the analysis of the peculiarities of his creative activity first of all we must note the presence of an associative style in the genre and plot of novels. A striking example is the extract from the novel *Mahomet, Mamed Mamish*, in which the benefactor of the family of the Bakhtiyarovs, Khasay Gulbalayevich, thinks of the transiency of his life: “*Oh, how the years are running rapidly! He pities the death of the old ma, who played the musical instrument tar and he had died recently, what a pity, when he was young and full of strength, sank into oblivion and it is impossible to return those days*” (Гусейнов 1988, 65). Associative parallel with the tar (an Azerbaijani string musical instrument), which they once confiscated from his owner without a twinge of conscience, when the frail man, who was not taken to the army for service because of some disease, came “*to Khasay to cheer up their company! Khasay guessed at once that the man had been called to serve in the army, but now he had come to him to express his gratitude. How many years have passed, but the encrusted nacreous, sensitive and obedient tar is looking as a new one*” (Гусейнов 1988, 65) as has remained the house of Khasay.

As an element of artistic narration the associative style will enable the comprehension of the text by the reader not once in order to allow him clear up the events from the life Гусейнов of the hero of the novel *Mohammed, Mamed, Memis*, not polishing the sharp angles in the interrelation of the members of the family of the Bakhtiyarovs, who were not his relatives on the line of his father. The lines of plot in the novel of the writer we think that are exposed in succession of the events, in the interrelations of Khasay Gulbalayevich, first of all, with his relatives: brothers, nephews and with those who are “*sick*” (the player of the tar), or incapable people (mentally ill Ildyrim), whose relatives appealed to him for help in order to get a permission not to serve in army.

Mentioning the richness and variegatedness of Ch. Huseinov’s prose the French writer Andre Vyurmsr highly appreciated the Azerbaijani writer’s novel *Mohamed, Mamed, Memish*. He, the Russian and Azerbaijani investigators of the creative activity of Ch. Huseinov mentioned the peculiarities of his style, in which “*skillfully were combined different layers of time, short extracts of the internal monologue, high speed of narration. And what excites the investigators of his creative activity is the problem of correlation of the genre with the style. Here we speak of the problem, which became the topic of the dissertation of E. S. Babaev titled Genre and stylistic peculiarities of the novels of Ch. G. Huseinov’s Mohamed, Mamed, Memish and The Family Secrets (2007). She declared about the genre and stylistic peculiarities of the narration of the writer as the main problem of poetics of his creative activity, more or less elaborated. His standpoint in the process of analysis of the novels of the writer: “Style is not only a means of cognition and evaluation, a means of convincing: in the process of cognition style organizes the cognized, being realized in the genre, forming the genre”. Not at all disclaiming the importance of elaboration of style and genre in historical novels of the writer, we are obliged to accept the main inferences of the dissertation, in which it is said clearly that its development demonstrates to us the refinement of the structure of narration on the background of style and linguistic idiosyncrasy, which represents complicated genre formations, which makes them interesting on the plane of investigation of the genre and stylistic peculiarities of poetics of his creative activity. A similar arrangement of the study of immanent laws of the text of literature is the condition of for achieving its aesthetical idiosyncrasy. In it the birth of the notion of style and precondition of its birth in the creative activity of Ch. Huseinov rests, first of all, on the elucidation of the specificity of the genre peculiarities of his historical novels. Ch. Huseinov himself defines the genre of his works highly arbitrarily, but as we see, proceeding from the main task of the work. The writer gave the following definition to his historical novel *Fatal Fatali*: “It is *documentary fantasy about the life which has already been**

lived”. But he defined his novel *Mohammed, Mamed, Memish* as a novel full of dreams with their clues, with naïve symbols, fantastic grotesques, sentimental retreats with epilogues similar to the prologue, - in the writer’s own translation from his native Azerbaijani language into his native Russian language”. Yes, they are not traditional and it is necessary to note the post-modernist writers, as if following the tendencies of the writers in this direction arbitrarily began to determine the genre of their works. But, in principle the individual author’s interpretation of the genre at the beginning of the narration reflects the fate of the writer, enlightener and revolutionary Mirza Fatali Akhundov and the history of the life and fate of Memish, native nephew of Khasay Gulbalayevich, son of his sister Tukezban, nicknamed in the family as “*nomad*”. Disclosing the life history and fate of Khasay Gulbalayevich in the world divided into two: one of them is those who had a blood connection with them, and of course here is Rena khanum, the other is, for example, the one where are Kazim or Varvara khanum. Kazim has found for himself subsistence, Varvara khanum supplies Khasay with food and drink. And there is nothing to be offended that she has been called after Gulbala, someone needs help, somebody needs support, the third one needs collaboration, but expressed in the material form. You understand, it is also extremely important.

E.S.Babaeva notes that his novels attract attention to the critical state of the socialistic society, to its spiritual degradation. According to him the writer strives to be wholly “*open*” to the society, objectively reflect the reality by occupying the position of an unnoticed observer, with it allow the reader appreciate and independently comprehend the created picture of life and living of the clan of the Bakhtiyarovs, drawing the real state of things. Written in the historico-literary context of the 1790s-1980s of XX century and beginning of XXI century, when in the high society everything was idealized and politicalized, threatening the elimination of national peculiarities in the narration, the writer became the pioneer, who laid his road through the clod of falsity and prohibition, thawing in the family relations and society. It explains why the writer appealed to the topic of the corruption of protection reining in the public life of the Azerbaijani society leading it to the lack of spirit enabling decomposition of the human spirit under the influence of totalitarianism. Along with the disclosure of the very acute, actual and painful problems in the republic the author focuses his attention on the exposure of family problems, which as if in miniature reproduce the traditions and customs of the Azerbaijani nation and people. In the family of Khasay, the main hero of the work, his brothers and sons respect and observe these traditions and customs. Relying on the events of the family clan the writer relies on several facts forming the line of the plot of the narration, on the example of the personal life of his son Khasay, Gulbala, Teymur Memish and his brothers.

What does the writer inform us on the road of life of Khasay? First of all, which he is particularly proud of? First of all, of his simple family origin, when he filled in the autobiographic documents, quite often connected with trips, or all kinds of travels: in one of the years he wrote proudly: “*I am the son of a porter, worked as a conductor of the tramway, then adriver, finished courses, public activity, then again courses, trade unions, then war and so on*” (Гусейнов 1988, 38). Yes, what to hide, it is true, my father was a porter, farm labourer, a farm labourer in the family of a bey. “*Memish’s grandfather from Baku, walked in the town, far and wide, how many loads he carried on his back; some will say “hambal” – porter, some will say pehlivan - a wrestler*” (Гусейнов 1988, 32). Memish’s grandmother from his mother’s side Melek-xanum was the daughter of an impoverished distinguished bek, Memish’s father porter Gulbala helped the bey, worked as a farm labourer for him, then after the death of the bey in the cold winter of 16 saves his daughter Melek from death. Then he married the bey’s daughter and his children were born.

When we studied the specificity of the composition of the novel *Mohamed, Mamed, Memish*, which consists of ten chapters, we paid attention to such a thing, which reminds the composition of N.V.Gogol’s poem *The Dead Souls* with some excuses. The

main hero of N.V.Gogol's poem Chichikov calls on the landowners from the town of N with the aim to buy dead souls, then to pawn them to get some capital. Khasay Gulbalayevich, unlike Chichikov, does not travel, or go anywhere, but in his own family clan "buys" the souls of his own children and relatives in order to raise own and public image. Owing to the support of the composition of *The Dead Souls*, we think that the writer wraps up the novel with family plot lines, exposing the activity of Khasay in rendering help to his relatives and close to him people, but turns out that he did it only for his own self in order at the end not to have any censure against his own self.

"The porter Gulbala died when he was not yet forty years old and Khasay was only thirteen years. He was obliged to take care for the whole family, including his brothers Aga was ten years old, Tukezban - eight, Heibat - even younger, Teymur had his teeth just appear" (Гусейнов 1988, 37). And when in their street the first tramway appeared, he began to work as a conductor. An interesting author's impregnation into the plot of narration, in which Khasay's father, a farm labourer, appeals to his son: *"Well, what will you do if I die?" - Father asks threateningly - Talk at random, bragging? Show to me your lying face to see. How dashingly you ride the horse, as if you are trampling my bones, you use my name to get fit from it!"* (Гусейнов 1988, 37), as if reminding the reader about the illegal activity of Khasay.

Thinking about his own authority and prestige for a long time, Khasay did not know what to do. His brother Ali from the same parents was taken captive and then worked in the mine. He sent a letter to his mother. The family asked his sister Tukezban to learn what the matter with him was. Khasay nursed everybody in the family, helped. It was necessary to drag him from there by all means, but how? His wife helped in it. They began an active activity. First they sent Uncle Heibat to learn how and why Ali had been exiled, in what he was accused. From half of the road he was asked to return back. At the beginning of the next year collecting all the necessary documents Uncle Heibat went there again. It became clear that Aga was in deportation, he was in the same address, lived in the house of a Russian woman. But how to release him from the exile and take him home, it was an action of honour. The third time Khasay went there himself. Accidentally he found himself on the same floor and the same hotel with the chief of the mine where his brother was. With the help of a crafty plan he took home his brother, cursed him that why he had come there with his wife and son. And again with endurance and persuasion they sent Ali's wife to deal with the necessary documents. In a month he got an unexpected letter that his son Alik was dead.

A striking example of kind actions of Khasay is in relation to his own son by name of Gulbala. It forms one of the main lines of plot, which narrates one of the main pretensions of the son to his father. The father knows that his son loves that girl and wants to marry her; the father compels the son to marry a well-known man in the town. But there takes place a misfire.

On the day before the suicide Gulbala called Memish to come to him in order to disclose his spiritual and what he had in his heart. His dialogical and mono-logical speech discloses the confrontation of relations of Gulbala with his father, with Rena, whom the father made her his lover, but then married a second woman and made all his brothers admit her duly. Gulbala got acquainted with Rena on the beach, saving her from a completely young boy, who stuck to her. He saved himself, because a great number of those young boys' friends attacked him. There was love between them, his first confession of love and said that he wanted to marry her. He took her to his grandfather's summer house and there was nobody. And Rena's mother went to her neighbor and had to stay there the night till the morning. In the dialogue-revelation of Gulbala Memish was interested: *"Why have you not married?"* In the reply to his question heard from him: *"I told father that I wanted to marry"*. But he asked: *"Whom do you want to make our relatives?"* I turned towards my mother for defense; I thought she will defend me, she loves me, trembles over me, always saying *"my beloved,*

my dear" and so on, but she also asked: *"Who are her parents?"* But she had even not a father (Гусейнов 1988, 78).

"Working in the office of the metro he helped Rena to get a job in one of the offices of metro. Could Rena even think that her gold medal did not mean anything for the entry into the Turkish department of the university" (3, p. 84). And in one of the days Khasay came to one of the offices of metro unexpectedly and met the girl, which he had seen her with Memish for the first time. After two days he telephoned to that office and asked quite unexpectedly: *"By the way, what about the girl who worked there, did she enter the higher school?"* - Care fore the employees. And when he learned that she had failed, he was glad, but with a voice full of grief: *"Very pity, Send her to me"*. And Rena came (Гусейнов 1988, 81). Her mother Varvara khanum taught her daughter all the time: *"It is necessary to have strong support all the time"* (Гусейнов 1988, 81). But when she saw a brilliant ring on her finger, she understood everything.

Convinced that the high position of Khasay and his big incomes, his son began to support the complaints of his mother with anonymous letters written against his own father. He even was ready to kill his father and rob his own parents. He decided to be on the wait of his father when he was returning from Rena's house. He stood at the entrance of the house waiting with a knife in his hand. The knife was with a spring support, it could enter the body as soon as it touched the body. While waiting for the father his throat grew completely dry. But when his father coughed in the entrance, his heart sank to his boots. He could not murder his father and then he chose to take revenge in some other way.

His fight with anonymletters against his father turned to be a useless loss of time. There was a friend and chief of Khasay, a man by name of Jafar (as a sign of respect people added the word *"miällim"* (teacher) to his name), whom his father was not thinking to dismiss, therefore Khasay wrote an application for being dismissed, then the thought: *"I shall write complaints, keep facts, but fill them with gossips, in this way we shall bring you up! We shall bring you up in this way! Yes, yes, we shall bring you up. We have brought up lots of men like you"* (Гусейнов 1988, 92). Then it became obvious that Gulbala *"did not write facts, but poured all kinds of dirt on his opponents! Now come and investigate, dismantle his castle with a goat's hogs! Not any trace of them will remain"* (Гусейнов 1988, 91). When Gulbala met his father's assistant by name of Amiraslan, the latter sobered him. The assistant exposed to him the methodology of writing and sending the anonymous letters. *"Of course, writing anonymous letters is a very mean action, but a very cunning science! For instance, take your father, my dear chief, he is a good organizer, very experienced and with lots of ties, knows his work, profession and so on. Do you agree with me?"* (Гусейнов 1988, 93). But Gulbala did not believe the words of that *"bald-headed fox"* (Гусейнов 1988, 93) and even began to pin him up: *"Excuse me, Amiraslan, you speak in a manner as if you have dealt with it yourself"*. *"Do you mean me? To fight by writing anonymous letters is very primitive!"* And he began to expose the kitchen of writing anonymous letters: *"It is better to sign it with your own name, family name and signature. In order to make everybody know you" - "Crank, not your name and your family name, but those of someone else. I tell you to learn the relations of the people! It is necessary to know who has a grudge against your enemy! Whom he will suspect! By doing it you will attract someone else to your game! Your enemy by all means will put to shame not the real one, but the one who will deny it. The person who was a neutral person yesterday becomes an enemy of your enemy! But in such cases certainly in anonymous letters there had to be the details concerning the person whose signature was in the letter"* (Гусейнов 1988, 93).

Amiraslan taught many other things to Gulbala and he was only sorry why he had not met him earlier. Through the history of the family of Khasay Gulbalayevich and Rena, who was accepted by all his brothers, despite the fact that he legally had a wife by name of Husniye, through whom the writer describes the history of love of Gulbala to Rena. But at first about Memish, whom the

beautiful Rena abandoned, she called Memish “*a taciturn*”, neither fish, nor meat. But about Gulbala, who was a relative of Memish, she did not think of him a bit at all. He guessed. “*Father wanted to become related with a great man and they proposed me his daughter, but then he bit his elbows, when he was dismissed with a crash*” (Гусейнов 1988, 56).

Memish did not stop with his questions and wanted to know what he had proposed her. “*What can I propose Rena? To take and marry her! But what about the money, where to get it from? From you? Shall I take it from your rich aunt Tukezban?*” (Гусейнов 1988, 78) When he learned that his beloved Rena had fallen into the hands of his father, it was too late. Rena had spoken to him about a handsome grey-haired old man before, yes, Gulbala did not attach any importance to it, because he also liked to compose whatever happened the more so he never saw a man with her.

The circle closed and once early in the morning Gulbala remembered his parents and Memish with his morals and his own wife! It was offensive to him, for his ownself, he would have a final talk with Memish, and he would put an end to the problem. The more so, Gulbala fell down from the window in front of the eyes of the woman who did cleaning and sweeping in the yard and in the street.

Khasay’s work was to communicate with people, to be careful, to know the men with high positions and to communicate with them and how Khasay would continue Amiraslan’s work. His own sister was married to Jabbar, chief of Khasay. Her husband Amiraslan achieved in the life himself. Assimilated the laws of how to rise in service, he even chose his future wife himself, taking into consideration the position of her parents in the society. But Khasay succeeded to overdo him. He married Husniye, who was an activist, a member of the Young Communist League. Nevertheless, Amiraslan found a kind and clever girl to marry.

Memish remember and knew. He taught and fed everybody and they knew it and tried to please him in everything. But Memish needed to disclose what he had in his mind after the suicide of Gulbala and consult and he would begin his talk with Gaya, who asked Memish: “*And what do you want in order Khasay leave Rena and return to Husniye khanum?*” (Гусейнов 1988, 12).

As it is seen from the plot of the novel, the main burden in the case of the exposure laid on the shoulders of Memish, who became an oilman Baku. He lives the honest life of a vanguard conscientious worker. With his image will be connected the fighting enthusiasm of the work The Investigators acknowledge that he will become the megaphone of the ideas of the writer in the struggle against Khasay’s activity aimed only to enrichment. After the service with the advice of his mother he came to Baku to live in the house of his uncle Khasay. The room of Khasay’s mother Tukezban was still unoccupied. But could she know how her brother’s charity would turn out?

Memish began to work in a multinational team of drillers headed by Gaya. A Russian young man Sergey, an Armenian Aram and Rasim from Dagestan were filled with pride for their labour and kind sense: their team produced a billion tons of oil for the country. Naturally, multi-number pages of labour days are filled with the romance of creation. The writer binds the events from the life of that team, what was designated after the death of Gulbala in the type of complicated struggle apposite forces – Memish and the Khasay brothers.

The image of Teymur comes into the mind of Memish, who refused his parents’ help and joined the army. In the family of the Bakhtiyarovs he was a person with natural gifts. He repeated all the qualities of his mother. As pure as the snow of the mountain. He was the best pupil at school. His obstinacy ruined the Bakhtiyarov family. Khasay was against his desire to serve in the army, but he joined the army, thinking that he fulfilled civic debt. His mother’s heart broke, when she got the news of his death.

Ali, one of the images did not know for more than twenty years that his mother had been alive. If there had not been the machinations of Grandmother Husniye, he would have not known that his mother was still alive. Nobody in the house knew how modestly they saw off his mother of the Russian nationality. Khasay found a new wife for his brother, who had saved him from exile, and he even did not remember what his Russian wife did for him, sheltered a sick Azerbaijani having pity on him. When he grew up thanks to the crafty machinations of Husniye and her desire to harm Khasay he went to look for his mother. Machinations laid the beginning of the turn of the terrestrial knot, which with its own hands have created Husniye and Khasay.

5 Summary

For some reason in Memish’s thought there appeared the lame old man with a stick, who very often passed under the window of Memish’s house, in the morning of that day, when there would take a dramatic murder and Memish would be killed by his relatives, he again met him on the road. He thought that perhaps there had come a punishment for Khasay and Husniye. After the second interrogation of Memish, after the end of the talk Sattar heard him say: “*You will hear of me! You will have a murder!*” (Гусейнов 1988, 123). At the end of the novel the bashful attempt of Memish to fight with Khasay ended with his death. With the instruction of Khasay his native uncles beat him at first, but Memish was from the same mother and father with them, smothered when they learned that Memish did not stop, but continued to disgrace their dynasty, again were in arms against him. The Khasay brothers, benefactors and the main support of the family, not thinking that him.

In the individual genre and stylistic current of the author’s narrative style an introspective layer is distinguished. The nuclear of which correlates with the native post modernistic form, which is characteristic for the creative activity of K. Abdulla. In it, the son of Khasay tries at the expense of his life to blow “the genealogy” of his father. In it Khasay’s son tries at the expense of his life to blow up “the dynasty” of his father. Memish, who was brought up in patriarchal traditions of the Azerbaijani nation, tries to judge the society of the affairs of his uncle Khasay. The moral purity of the spirit as of his cousin Teymur allows him to adapt to those, which took place in the family clan in the family of the Bakhtiyarovs. His aspiration for the discovery of negative occurrences along the whole novel will be shown in tense spiritual searches of Memish, as in the searches of other characters of the novel: Gulbala, Teymur, Fatali, who was a historical figure and enlightener, who in conditions of hypocrisy, falsehood and consumption of the contemporary and historical time chose individual-moral-spiritual means of fighting with a whole family mafia in the diagnosis of the public disease: money-grubbing, protectionism, thieves’ cant and other negative phenomena in the life of the Azerbaijani society.

Specific is the denouement of the plot of the last chapter of the novel, which has a double tail-piece. It informs that after the known session of the town committee of the party Memish was smothered and his corpse was hung. There were rumors that he had committed a suicide. But in the second denouement of the plot the live Memish hurries. One can feel the smell of shashlik, but it is deceptive. With this scene the writer shows that there is still an opportunity to hope that not everything has been lost in the fight with family mafia, in miniature reflecting the mafia of the country, “*in which the national pride is exchanged to the aspiration for enrichment, career and enjoyment with blessings of life*” (Сафаров 1989: 116).

Literature:

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THE LEADER'S CONSCIOUS AUTHENTICITY INDEX AS A BENCHMARK FOR LEADERSHIP STYLE PREFERENCE AND THE NATURE OF THE ORGANIZATIONAL ENVIRONMENT

^aVERONIKA KOLENÁKOVÁ, ^bFRANTIŠEK MILICHOVSKÝ, ^cJÍŘÍ KOLENÁK, ^dVRATISLAV POKORNÝ

^aBrno University of Defence, Faculty of Military Leadership, Kounicova 65, 662 10 Brno, Czech Republic

^bBrno University of Technology, Faculty of Business and Management, Department of management, Kolejní 2906/4, 612 00 Brno, Czech Republic

^{c,d}Newton University, a.s., Rašínova 2, 60200 Brno, Czech Republic

email: ^averonika.kolenakova@unob.cz;

^bfrantisek.milichovsky@vut.cz; ^cjiri.kolenak@newton.university;

^dvratislav.pokorny@newton.university

Abstract: The text presents one possible concept for identifying the intensity, degree, and level of leader authenticity in the context of leadership styles and prevailing characteristics of the organizational environment, with the potential overlap in terms of the possibilities of cultivating and developing qualities that foster authenticity. The paper introduces partial outcomes of pilot re-search in this area. The first part discusses the framework of the organizational environment nature and presents an index of conscious authenticity for leadership. The next part discusses the center of gravity of variations in people's leadership styles in relation to the characteristics of the organizational environment. The final part presents the partial results of the pilot survey in the context of the Conscious Authenticity Index, leadership styles centers of gravity in relation to the characteristics of the organizational environment and Generations X, Y, and Z.

Keywords: authenticity, adaptation, system complexity, conscious authenticity index, leadership styles, a center of gravity of leadership styles

1 Introduction

We consider the Conscious Authenticity Index, the center of gravity of leadership styles, and the nature of the organizational environment to be significant indicators. The Authenticity Index reflects the degree of readiness, and openness, but also constancy in change. It relates to the theme of individuation through aspects such as the integrativeness of the individual, the coincidence of variability, and fluxion resulting in self-actualization. It concerns the ability to respond to change as well as to embrace and initiate it proactively. Leadership styles and their centers of gravity are related to individuation and self-actualization in consensual reality. The nature of the organizational environment creates the context for cognition, behavior, and action of people and human systems, and sets their basic frameworks and parameters. The leadership style, the organizational structure of the human system, and its internal and external environment form a functional system (Petrová, Konečná, Hornungová, 2023). It is the nature of "logics" of patterns (structures) of organization of interactions, relations of communication, influences, relationships, and "expectations" of a given unit (its internal environment) and its external environment. If the essence of the logic is, for example, competition or "struggle" in the sense of "who is stronger" or "war" in the sense of destruction and occupation, then the whole is organized in the "spirit" or according to the nature of this logic. Similarly, the nature and place of control, power, and influence, regulation. The medium or transducer of the relations of the whole plus environment system may be function, activity, service, etc. If profit is the essence of the logic and the effect of the "ex-change" between the inside and outside, then the indicator of effectiveness is its increase. Then the economics and ecology of the whole, including the nature of the preferred leadership style, are derived. However, profit does not equal wealth. The nature and degree of profit can be substituted and quantified (coinage), represented by "security" or self-security, with the ultimate motive being "survival" and its subjectively experienced "level" by the recipient of the profit.

The pedant of his logic is "unidirectionality" in the sense of drawing on environmental resources. The nature of wealth has a broader, ecological aspect of a more complex, holistic and substrate character, a kind of meta-context of "profit" (which can

be of a different nature and is a two-way process) and a transaction of energy exchange, between the inside and outside:

- Profit as an effect of the exchange ratio (cost - exchange - income) also complements the topic of loss.
- Wealth as an effect of the possibility/opportunity ratio - bidirectional relationship = ecological prosperity (holistic - organizational whole plus environment).

Profit and wealth, in relation to utility and the implications of the different natures of their logics, are addressed in Kahneman's prospect theory, which develops the idea that changes in wealth rather than property stocks are the carriers of utility (Kahneman et al., 2010; Kahneman, Tversky, 1979).

The nature of logic also refers to the locus of "power," in the sense of control, regulation, and decision-making, and subsequently translates into the form of organizational structures, such as hierarchical or networked (Hornungová, 2022; Petrová, Špatenka, 2022). The type of organizational relation-ships nature translates into the logical preference for ways of cognition on the cognitive continuum (Hammond, 2000; Kostroň, 1997), the formation and development of communication patterns and modes, including modes of encoding in the language (Bateson, 2018). Coding can be digital, analogical, iconic, metaphorical, arbitrary, figurative, symbolic, and others (Blumenberg, 2015; Bateson, 2018; Petříček, 2009; Foucault, 2007; Alleau, 2014; Cassirer, 1996; Goodman, 2007; Durand, 2012). Changes in an individual's thinking, cognition, and behavior are organized according to the characteristics of the organizational environment. The organizational environment contributes significantly to the formation of the individual and the human system, particularly in terms of individuation and self-actualization, as well as in terms of preferences for ways of knowing, cognitive models in reasoning, and decision-making (Sládek, Ullrich, 2018). The influence of the organizational environment on individuation and self-actualization is low. The ability to reason, to understand the connections between phenomena and processes, to be aware of manifest and non-manifest aspects and contributing influences, to respect the past and experience as well as to estimate the future, to construct theories and projects from ideas, visions or expectations and assumptions, and to create meaningful projects for their implementation, is the theme of the various expectations associated with the organization and management of human systems, management and leadership, whether in institutional and corporate or entrepreneurial entities, with their selection, preparation and training (Nathan et al., 2019; Sendjaya, Sarros, 2002; Walumbwa et al., 2008).

The foundations of this ability to understand, construct and create lie in the degree of fluidity, consistency, and "adaptability" of the thinking of every person who is in some way involved in organizing, managing, and leading in human systems, from the "lowest" levels with direct practical implications (task situation) to the "highest" levels representing systemic, strategic decision-making and action. The dominant trend to find out the extent of this "capability" is organized around the assumption of the relevance of intelligence and its specific forms to correct cognition (perception), and reasoning. It relies on revealing its extent and quality through testing. If the measure of this ability, the measure and quality of critical, systemic, and strategic thinking of a particular person is "survival" (in the sense of preservation of function) and prosperity (of the individual, of the whole system in the environment and context), then the ability to make correct judgments in "non-parametric" or non-standardized conditions must also be taken into account, and, as mentioned above, the ability to make or take an adequate, realistic decision based on judgment and to implement it effectively, i.e., to act, be it at the situation (tactical), context (operational) or systemic and conceptual (strategic) level.

The characteristic features, thinking requirements, and decision-making algorithms of the organizational environment (corporate or business) within which the individual exists professionally and gains or develops experience come into "play" or serve as co-factors and correlates, and specific personality factors. These factors contribute to the way in which an individual reflects and valorizes experience, and uses, cultivates, trans-forms, and develops the natural potentials or, in the modern language of informatics, reformats, reprogrammes or, on the contrary, stabilizes and standardizes the skills, abilities or so-called competences (Ullrich, Ambrozová, Sekanina, 2018).

The nature of the relationship between the internal environment and the external environment influences the nature of adaptation and learning patterns. The evolution of modern environments points to one significant factor that does not correspond to mechanistic thinking about organizational environments (Lecic et al., 2023). The organizational unit plus the environment should be thought of as a dynamically evolving complex whole whose sub-systems interact, evolve and change qualitatively. This places different demands on the nature of adaptation. If the environment is "static" then demands approximate to identification, external formation prevails with varying degrees and forms of intervention into the internal environment of the whole system (individual, team). It works with information as a command, an instruction leading to the application, the realization of those "external" required internal resources resulting in self-actualization in preformed forms and patterns of cognition and behavior, in relation to the requirements placed on the "outputs" in the form of functions and activities.

If the environment is dynamic, then it requires transformation and change of a trans-formational character in the units contained in it. It treats information, communication, and knowledge in an initiating way, and accentuates auto-transformation and resources from the internal environment of the whole, i.e. it initiates a "transformation" of the ratios of qualities of active or activated internal resources. The effect is auto-actualization (self-actualization), self-redundancy in the sense of creating new patterns of internal potential arrangement of the whole system.

Leadership and management naturally share a number of common features as well as significant qualitative differences, and have different origins and histories (Adair, Reed, 2009; Adair, 2006; Adair, 1993; Covey, 2005; Armstrong, Stephens, 2008). In assessing management, the activities and functions of the manager are evaluated, with an emphasis on order, organization, process regulation, stability, and control. In contrast, management or leadership tends to emphasize values, mission, developing motivation, and contributing to change. With the development of management, human, social and cognitive sciences, there is a growing share of efforts to grasp the topic of formerly "leadership" and more recently the leadership of people and human systems. The notion of leadership and management is burdened by historicism, the vagueness of definitions, differences in the attitudes of researchers, and the reasons and goals of the research. The effect of the involvement of the natural sciences as well as modern sciences such as cognitive science, cybernetics, systems science and information theory also plays a significant role. They have broadened the base of the spectrum of approaches to conceptualizing leadership styles (e.g. systemic). Similarly, the changes in environmental trends have translated into an increase in the importance of situational leadership (Dirani, et al., 2020; Khan, et al., 2015; Koleňáková, Ullrich, 2021). The dominant research trend in this area is towards individuals as "members" of human systems and their cognition (epistemology and cognitive sciences), behavior (behavioral sciences), decision-making, and action (cybernetics, communication, systems, and information sciences). In particular, from the perspectives of autopoiesis and self-regulation (e.g., learning systems, organizations), i.e., on the conscious self-management and self-development of people and human systems. It is related to the change or transfer of the locus of control and regulation from the external environment, or hierarchically superior level, to the

inside of the whole. That is, the direction "inward" and "downward" at the level of cognition, reasoning, decision-making, action and behaviour of people and human systems in dynamically changing and highly relationally complex task situations and contexts. At the same time, the temporal "length" of the stability of contexts and paradigms has changed in the sense of increasing the speed - the dynamics of their qualitative changes. There is a growing requirement for the ability to create knowledge, make decisions and act in highly complex and dynamically evolving situations and contexts. This is the reason for the growing interest in authenticity, which derives both from the growing trend of demands for the qualities of organizational structures in the sense of autopoiesis and from the demands for relative "autonomy" (self-regulatory autonomy) and "self-sufficiency" (the transfer of information and the regulatory effect of the superior level always lag behind the real situation). Conscious self-poiesis is the background and source of authenticity, which basically means the being and acting of the individual in accordance with the real Self, its manifestations (behavior and actions) are manifested in ways that correspond, correlate, or are in accordance with inner thoughts, experiences, feelings, emotions, preferences, values, and beliefs. Avolio et al. (2004) and Avolio and Gardner (2005) rely mainly on the foundations of humanistic psychologists Rogers et al. (1959), Rogers (1963), and Maslow (1981), Maslow et al. (1971) in their conception of authenticity. These authors focused attention on the development of fully functioning or self-actualized persons, i.e., individuals who are "tuned" to their essence and see themselves and their lives clearly and accurately. Because fully functioning people are not burdened by the expectations of others, they can make more reasonable personal decisions. Interestingly, Maslow et al. (1971) conceptualizes self-actualized people as individuals with strong ethical beliefs or structured value frameworks. Arguably, these ideas from humanistic psychology provide valuable references for thinking about authentic leadership development. Authentic individuals are true to their inner values, thoughts, and feelings (Harter, 2002). Therefore, the key to authenticity is knowing and understanding oneself, one's life and identity, and self-awareness. In this sense, they build on or complement and develop the theme of individuation and self-actualization elaborated by Jung (2019), rather than concepts emphasizing socialization, individuation, and self-actualization. Individuals with stronger expressions of authenticity are more aware of their values and more likely to act in ways that are consistent with those values. There is also evidence that more authentic individuals are characterized by higher levels of psychological well-being, higher engagement, and increased performance (Harter, 2002).

One of the important insights in the case of authenticity is that it is a self-referential state of being. It is faithfulness or truthfulness to oneself that is actualized at the individual level without requiring external influences. A related construct, authentic leadership in organizations, is defined by Luthans and Avolio (2003) as a process that draws on both positive psychological capabilities and a highly developed organizational context, resulting in both greater self-awareness and self-regulated positive behaviors on the part of leaders and co-workers, which promotes positive self-development. Gardner et al. (2005) suggest that through increased self-awareness and self-regulation of authentic leaders, the development of authenticity in followers is supported. Followers' authenticity in turn contributes to their well-being and the achievement of sustainable and genuine performance. In this context, Shamir and Eilam (2005) provide the following four manifestations of authentic leaders:

1. they are true to themselves (without conforming to the expectations of others) rather than faking their leadership,
2. they are motivated by personal beliefs rather than by achieving status, honors, or other personal benefits,
3. they act by themselves, without imitating (i.e., they lead from their own personal perspective),
4. their actions are based on their personal values and beliefs.

Kernis (2003) identifies self-awareness, unbiased processing, relational authenticity, and authentic behavior/action as essential

elements of authenticity. Ilies et al. (2005) use similar terms in their model, however, the meanings are shifted to better reflect their conception of authentic leadership. Specifically, they use the term "balanced processing" as opposed to unbiased processing in recognition of the extensive research from cognitive psychology that suggests humans are inherently flawed and biased processors of information (Fiske, Taylor, 1991; Tice, Wallace, 2003; Gaddy, et al., 2017; Harms, et al., 2013). Rather than claiming that authentic leaders and followers are free of cognitive biases, they argue that they are inclined and capable of multidimensional insight into issues and multiple perspectives because they evaluate information in a relatively balanced way. Our experience is related to this context and is reflected in the category of mental mobility on the cognitive continuum (Ambrozová et al., 2016; Hammond, 2000; Kostroň, 1997), involving the component of cognitive variability. Similarly, we consider the term relational transparency to be more objective than the term relational authenticity because it better reflects the open communication between authentic leaders and followers in communicating and sharing information, and the transparency of the organization's interpersonal relationships with each other, and relationships with the external environment of the organizational unit.

The findings of the preliminary research on the issue of authenticity and individuation in terms of relational aspects, which was conducted between 2015 and 2021, point to the possibility of considering the Index of Authenticity (IA) as a more general and comprehensive model, corresponding to the tendency of followers to prefer in leaders, firstly, personality integration, secondly, cognitive variability, and the sub-factors that make up the content of the Index of Conscious Authenticity (ICA). We consider the Index of Authenticity (IA) as a comprehensive summary of selected aspects in relation to group members' preference choices. These are factors related to authenticity for individuals who received the highest frequency of choices from group members. The index includes individual-conscious and unconscious indicators, including cognitive variability; original thinking; personality integration; self-awareness; internal locus of control and location of the center of gravity of interpersonal relationship characteristics in specific octants, and parameters with higher levels of conscious control and regulation. These parameters include transparency, ethics, the steadiness of action, and self-awareness, and in their totality, they constitute the content of conscious authenticity. Thus, we consider the Index of Conscious Authenticity (ICA) as the cumulative value detected by the parameters of the ALQ method (Avolio, Wernsing, Gardner, 2018; Banks et al., 2016; Baron, 2015; Hsiung, 2012).

	Mean	Std. deviation
Transparency	9	0.05237
Ethics / morale	7	0.18241
Balanced procedure	8	0.03125
Self-actualization	8	0.13254
Conscious Authenticity Index	8	0.12109

Tab. 1: Summary of the results of the Conscious Authenticity Index sub-factors

In terms of other outcomes and data from the comprehensive psychological and social diagnosis of individuals with higher frequency and preference of voting, no significant association was found with scales such as ambition, aspiration, extraversion, introversion, dominance, submissiveness, sociability, etc. Also, no significant association was found between the frequency, duration, and focus of education and courses in competencies, skills, and abilities for management and leadership and higher frequency and preference of choice. There are indications of significance for courses and training focused on personal development. The sub-indicators with a potentially significant link to authenticity, forming the overall authenticity index, can be communicated as follows: the highest frequencies and preference choices were obtained by individuals (both men and women) with the following characteristics in the indicators

studied. No significant difference was found in the values achieved by individuals for these indicators (σ - standard deviation was low).

The centers of gravity and variations of leadership styles in relation to the characteristics of the organizational environment

In terms of the characteristics of the organizational environment and, in their context, preferred leadership styles, we attempted to identify potential correlations. The morphology of leadership styles and preferred communication patterns of logics of cognition and behavior, as well as the localization of the "locus" of power (control, regulation, and decision-making), allows us to estimate with more than haphazard success the nature of the organizational environment and vice versa. The organizational environment is an environment made up of people and human systems. Different organizational environments differ in their explicit or implicit values and "traits" in the nature of their dominant benchmarks, functions, and activities. These can then be organized on a multidimensional model that can be thought of as a "reference" medium for both specific leadership styles and the nature of specific organizational environments or task situations. The diagram below contains two basic axes and one additional axis. The axes can be thought of as bi-polar dimensions / continua.

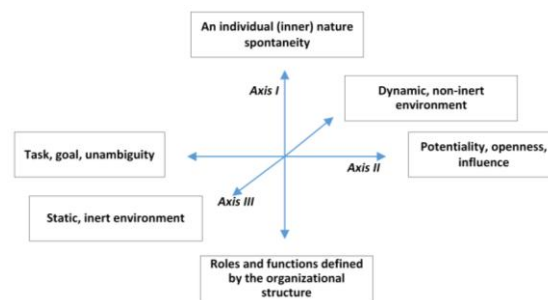


Figure 1. Multidimensional model and the organizational environment

Individual axis describe areas of the organizational environment as follow:

- Axis I has at one pole a preference for orientation to the individual (naturalness, spontaneity), the other pole represents orientation to roles and functions, given by the organizational structure.
- Axis II has at one pole an orientation towards task, goal, causality, and clarity, the other pole is represented by potentiality, openness, plurality, and influence.
- Axis III completes the model and allows the nature of the organizational environment to be captured. It has at one pole (SQ) the maximum of the static and inert environment (ecology and economics of the abiotic mechanistic), the other pole (AP) represents change, alteration, and non-inertia in the sense of the permanence of the course of juxtaposition, interrelation, and influence (ecology and economics of the living). An example is the immutability of information at one pole (it is only "trans-mitted") and the transformation of information in the process of mutual communication at the other. The third dimension enables to distinguish the nature of the organizational environment and the adequate nature of the leadership style in terms of the importance of the external-internal influence ratio; the importance of the nature of communication and adaptation; the preference for the locus of control and regulation; and the nature of information in communication (information as instruction and as initiation).

The environment preferring the status quo (SQ environment) applies a proven formula, method, and methodology (in the sense of an established, stable set of algorithms), and changes are innovative in nature. The application of cognitive models and

methods accentuates activities of an auto-centric nature (in its own interest), self/affirming. It cooperates for the survival of the "parent" algorithm", heads for the homogeneity of totalitarian type, aggressively reactive action adaptation to change, external locus of control and hierarchical structure of regulation, and cooperation by subordination - static, systemically, and functionally rigid, closed, static - stable, hard. It acts as a static, non-inertial whole.

Environment focused on self-creation, self-poiesis (AP environment), transformation, and change of the inner - inquisitive, active, proactively "mutates," adaptation is flexible, proactive work with change, partnership collaboration with prevailing respectful context. It behaves and acts non-inertly, relatively "free," openly, and "ready" to change (in the sense of responding positively to change by changing itself in terms of external and internal stimuli and initiations), intelligent living organismic whole, actively "interacting" with the environment. The coefficients SQ and AP represent potential values of preferences for "logic" of the behavior of organizational structures preferring these leadership styles. These "logic" or patterns of communication are reflected both in the characteristics of the corporate culture and relationships between people and in the preference of people's leadership styles. Secondly in the way people think and their mental condition, personality characteristics, and, in turn, in the quality of their lives as well as the people involved in their relationship, either family or co-workers.

Other themes that enable the distinction between the nature of the environment tending to the character of SQ or AP are, e.g., the theme of the economics and ecology of change and behavior of the whole, the theme of the hierarchically organized, and self-organizing, and within these the issue of the locus of control and regulation (from the outside - from the inside). A specific issue is a closedness or relative openness of the systems of the whole, openness and "readiness" to adapt to change, to respond to change by passive or active resistance, or acceptance of change or even its proactive initiation. The paradox of the duplicity of structurally closed systems, which are always open to the external environment, becomes apparent (Hoque, Raya, 2023).

Systems with a higher degree of freedom in terms of the relationships between members are better "transported" to the influence of changes and the occurrence of random states. They also differ in the nature of feedback adaptation to change. Systems with a higher degree of rigidity prefer control, and negative and reactive feedback, the nature of their behavior is mechanistic, and causal logic prevails. Systems with a higher degree of freedom and "readiness" to openness prefer self-control, and positive and proactive feed-back, which has a "self-regulatory" change effect on both the source of the stimulus and the subsequently responding "link" of the communication "circuit," the nature of their behavior is organismic or biotic (living systems), and the cybernetic "logic" prevails. This effect is sometimes understood as a learning organization. Thus, the organizational unit is qualitatively transformed in "communicating" (creation - transfer - application of information and knowledge).

Individual organizational settings also differ, for example, in the way they implicitly think about their members, whether they are primarily people (Heidegger, 2000) or workers (Novák, 2006) or things or mechanisms for performance, "sources" of energy performing work, functions and activities, etc. These assumptions have a significant formative influence on the structures of relationships and their organization. Practical experience shows that by developing authentic leadership, it is possible to create foundations on which other, specific leadership styles can be conceived or built, as shown by Blanchard (2001; 2020). Authentic leadership shares externally significant correlations with the concept of transformational leadership, and when a comparison is made between a real transformational leader and an authentic leader in terms of personality, it appears that both strive to be authentic in their behavior and actions (Alok, Israel, 2012; Avolio, Gardner, 2005). However,

transformational leadership focuses more on the development of followers and their leadership roles, whereas authentic leadership is concerned with the development of followers in terms of a self-sense more generally. Both leadership theories emphasize, for example, the importance of self-awareness, positive role modeling, followers' self-determination, positive exchanges between followers and leaders, supportive and ethical organizational climates, etc. Authentic leadership focuses more on the effective handling of task situations and places more emphasis on personal, and mindful development. At the core of the differences between these theories, we can see the different concepts of attitudes, which, however similar they may appear from the out-side, make them two distinct constructs. The transformational one emphasizes the external and adaptation to the external, highlighting an *ab alio* attitude (Lat. *ab alio* - from the other, external); the authentic one emphasizes internally conscious change and proactive transformation emanating from the self, highlighting an *aseite* attitude (Lat. *a se* - from the self, from the internal environment) in relation to environmental change. On the other hand, their similarities and correlations also make them complementary constructs. Authenticity is also closely related to the issue of a person's ability to withstand/manage challenging (sudden, unexpected, emergent situations or events perceived as random, *cri-sis*, or increased risk). Thus, it has overlapping potential in the field of project management or crisis management.

In general, each human system in relation to the organizational environment develops and prefers specific leadership styles, which differ from each other. In this sense, there are different leadership styles, and similarly, the literature offers different approaches and concepts of leadership styles. However, there are not very sharp boundaries between them, and some of their aspects overlap, intertwine, and assimilate, while others are diametrically opposed, complementary, mutually coinciding, or condition each other. For the purposes of the model, twelve leadership styles have been selected that carry the potential for separability and mutual definability based on the personal qualities of individuals, aspects of the organizational environment, or the conditions and circumstances of task situations in which people and human systems perform activities and functions, cognize, reason, decide, and act or behave (Blanchard, 2020; Sarros, Santora, 2001; Van Dierendonck, 2011; Chaudhry, Javed, 2012; Van Vugt, M., et al., 2004; Krause, O'Connell, 2011; Samad, 2012; Ely, et al., 2010; Ambrozová et al., 2021; Taylor, Cornelius, Colvin, 2014; Blanchard, Zigarmi Zigarmi, 2017; Hendriks, Karsten, 2014):

1. Transactional leadership emphasizes mentoring, development, and follow-up of team members. The leader works with rewards for successful task performance and sanctions for task failure. Transactional leadership is manifested by short-term goals and clearly defined structures.
2. Helpful leadership focuses on helping team members and is sensitive to their needs. It helps develop individuals' strengths and commitment. This translates into greater efficiency and productivity.
3. Liberal leadership is characterized by leaders delegating decision-making and responsibility to their team members. Subordinates have the authority to make decisions about their work. Teams are given recommendations and sources of information when needed, otherwise, their work is not interfered with. Ensuring sufficient resources and tools is necessary for effective team delegation.
4. Pacesetter leadership is considered one of the most effective for achieving quick results. Leaders are set toward performance and motivating team members to achieve goals. They have higher expectations and delegate responsibility for achieving goals in a dynamic environment to their subordinates.
5. Autocratic leadership focuses mainly on productivity and efficiency, with communication providing clear instructions to accomplish goals and defining what and how subordinates are to perform. Leaders make decisions

- independently and quickly, creating a stable and predictable work atmosphere for team members.
6. Bureaucratic leadership requires employees to follow rigid rules, responsibilities, and procedures exactly as laid down. There is no collaboration or creativity required. Each team member has a clearly defined job description that leads to performance.
 7. Transformational leadership encourages others to achieve their goals and motivates, and inspires through an inspiring environment for personal and professional development. At the same time, it requires clear communication, goal setting, and staff motivation. It emphasizes goal achievement as the work of the whole team.
 8. Coaching leadership helps to develop new skills, freedom, and creativity in thinking, contributes to the competence of team members, and helps a confident company culture. Leaders who coach are often considered valuable mentors.
 9. Systemic leadership creates the basic value frameworks of the organizational system, discovers the possibilities of their transformation, and helps to formulate them. It clarifies the meaning, significance, and interrelationship between the functions and processes of the organizational system and its environment. It cultivates the environment and facilitates shared understanding. Naturally and continuously reflects the evolution of the conditions, circumstances, and context of the organizational environment.
 10. Visionary leadership is characterized by a strong ability to drive development and introduce change by inspiring employees and easily gaining confidence in new ideas. It is also characterized by a strategic mindset.
 11. Situational leadership is based on an analysis of the current state of the team, situation, and environment. Realistically adapts leadership style to the conditions and circumstances of the situation, task, and environment. Consciously uses a variety of leadership styles in light of the current state of the team and the individual characteristics of its members. It focuses on creating functional and pragmatic relationships within the scope of the organizational responsibility.
 12. Democratic leadership seeks the maximum possible involvement of team members in decision-making processes and achieving consistency in performance. This leadership style is often credited with fostering higher levels of employee engagement, promoting creativity and workplace satisfaction. The team is encouraged to share ideas and concepts and stimulate group discussions focused on the results of the effort. It also calls for less managerial oversight.

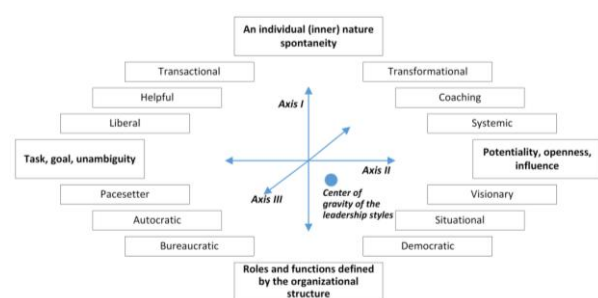


Figure 2. Multidimensional model and the organizational environment and center of gravity

Specific criteria for distinguishing the characteristics of the "nature" of the organizational environment may be the tendency to prefer people orientation or function orientation (vertical) and similarly to prefer stability or change (horizontal). Leadership style preference can be identified both in terms of individuals and leadership style preference regarding the nature of the organizational environment or task situation. The results enable to locate the "center of gravity" of the leadership style in the space of the "model" and examine their correlations, which are reflected in their "distance"; in the case of long-term monitoring, it is also possible to follow the trend of their "direction," for example, when introducing organizational changes of a

qualitative nature or changes in the behavior and actions of leaders in terms of optimizing the leadership style in relation to the nature, functions, and activities of the organizational unit, environment.

2 Materials and Methods

135 respondents/managers in leadership positions from both institutional (corporate) and entrepreneurial backgrounds participated in the pilot project. The following assumptions formed the basis of the research. The assumption of a relationship between the authenticity index measure and the location of the center of gravity from a corporate/business perspective. The assumption is that authenticity, as a cumulative value and/or its sub-parameters or pairs or triples of parameters, may exhibit a relationship with organizational environment characteristics and preferred leadership or personality styles.

In the first phase, the significance of the sub-styles of leadership in relation to the characteristics of the organizational environment was identified through focus groups. In the next step, the following meanings of relational closeness were investigated:

- Leadership style center of gravity x organizational environment character - corporation/entrepreneur;
- Leadership style center of gravity by organizational environment x Conscious Authenticity Index;
- Leadership style center of gravity x Conscious Authenticity Index ratio;
- Conscious authenticity and sub-items x leadership styles;
- Conscious authenticity x organizational environment.

2.1 Focus groups

The purpose of the focus group assignment was to determine, using ten points, the ratio of trend, inclination, importance, and leadership style preference on the bipolar axis of the SQ/AP dimension. An expert investigation using the focus group method (Fern, 1982; Babbie, 1995; Miovský, 2006; Morgan, 2001; Veisová, 2009) established the following parameters for leadership style preference ratios in relation to organizational environment characteristics. The mean values obtained are presented in the table 2. Distribution of leadership styles by the level of relevance to the environment can be split into two groups:

- SQ group - leadership styles with higher relevance to the SQ environment;
- AP group - leadership styles with higher relevance to the AP environment.

Distribution of leadership styles by the reported levels of conscious authenticity - low, medium, and high conscious authenticity index in relation to preferred leadership styles.

- group α = low level of authenticity;
- group ω = medium level of authenticity;
- group θ = high level of authenticity.

	SQ	AP	ICA	
Transactional	6	4	5	α
Helpful	6	4	6	ω
Liberal	5	5	5	α
Pacesetter	3	7	6	ω
Autocratic	8	2	6	ω
Bureaucratic	7	3	4	α
Transformational	4	6	5	α
Coaching	3	7	8	θ
Systemic	2	8	9	θ
Visionary	4	6	7	ω
Situational	1	9	10	θ
Democratic	4	6	5	α

Tab. 2: Distribution of leadership styles by the level of relevance to SQ and AP environment, and the Conscious Authenticity index (ICA)

3 Results

For the purpose of the study, we have to define the target population. The main distribution is by the individual generations X, Y, and Z. These generations represent different approaches to human beings and behavior. Individual generations are defined by the individual’s year of birth (Crampton et al., 2009; Hertz, 2016):

- generation X: born from 1965 to 1979;
- generation Y: born from 1980 to 1999;
- generation Z: born since 2000.

According to the approved survey, we have found that there are differences between individual generations and their preferred leadership style. The observed results, displayed in table 1, prove that generation X works with fewer obstacles in comparison to other generations. This generation is also the most leadable group. On the contrary, generation Z is the most fragile generation. There is a risk of lower cooperation among leaders in specific areas; especially bureaucratic leadership is unacceptable for them. In terms of age, younger individuals are more responsive to the behavior of a leader (Crampton et al., 2009; Martin, 2005).

According to the obtained results, the center of gravity should not be verified. All evaluated generations have a similar perception of individual leadership styles. There is only a change in their specific chart flat. When the flat is designed as a personal comfort zone, then the individuals want to follow their manager or supervisor. Concurrently, with the lower age of a person, the flat becomes smaller (see Figure 3).

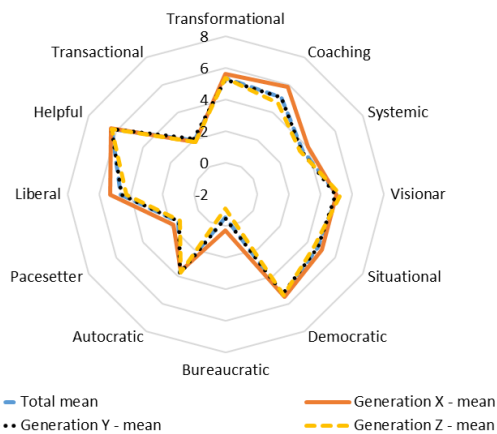


Figure 3. Center of gravity according to individual generations

In the context of the preferred leadership style, each person is located in one of four quadrants. Each quadrant represents different preferences. According to the gained results, the most persons are members of quadrant 1. That means, without care of the generations’ kind, the majority want to be individuals with their own nature, and they want to be open to new ideas and future potentiality.

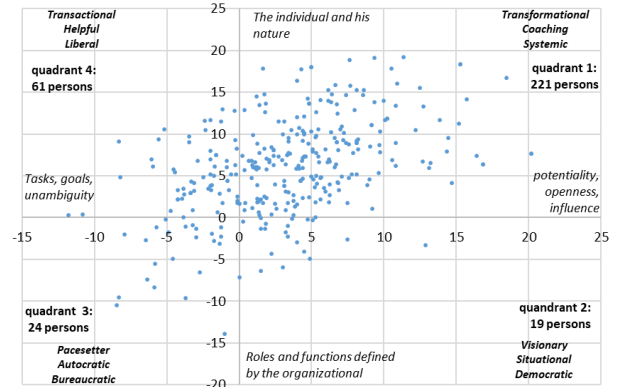


Figure 4. Distribution of leadership styles into individual quadrants

The individual relative distribution of each generations are showed in Table 3. From the generations’ point of view, most people become part of quadrant 1, no matter of individual generation. In case of changes in quadrant 2, there is an obvious decrease in a per-son’s rate from generation X to generation Z. Against this situation, in quadrant 3 is rate increasing.8 Rate of quadrant 4 is almost similar in all generations.

Q	Generation X		Generation Y		Generation Z	
1	43	66.15%	96	66.21%	178	68.46%
2	6	9.23%	6	4.14%	13	5.00%
3	3	4.62%	12	8.28%	21	8.08%
4	13	20.00%	31	21.38%	48	18.46%
Σ	65	100.00%		100.00%	260	100.00%

Tab. 3: Pivot table of generations and quadrants

We compared preferred leadership styles within authentic leadership parameters (ALQ) by correlation matrix (see table 4). People preferring transformational leadership, have a higher rate of self-awareness. Except transformational leadership, higher self-awareness have also systemic, visionary, situational, and democratic. For transformational leadership is important also transparency of their personal activities. If the persons prefer systemic leadership, then is possible to find out correlation with moral and ethical personal qualities - they should drive themselves with own internal compass. Other combinations do not verified by Pearson correlations – their values are not statistical significant. Other potential connections in Pearson correlation matrix do not meet the significance level. However, these connections have to be monitored to understand relevant approaches of managers’ work within specific staff generations.

Leadership	ALQ	Transparency	Morale/ethics	Balanced procedure	Self-awareness
Transformational		0.438887	0.233438	0.195683	0.506921
Coaching		0.200184	0.23361	0.217971	0.276690
Systemic		0.263558	0.511210	0.179464	0.481275
Visionary		0.268449	0.207445	0.142989	0.436589
Situational		0.226877	0.294237	0.201983	0.455526
Democratic		0.135228	0.218958	0.176917	0.446032
Bureaucratic		-0.09061	0.108877	-0.03427	0.126644
Autocratic		0.082187	0.171972	0.006419	0.284760
Pacesetter		0.173186	0.224826	0.141572	0.258977
Liberal		0.191423	0.200101	0.130635	0.297309
Helpful		0.186509	0.232257	0.028026	0.313925
Transactional		-0.03438	0.124140	0.036317	0.204299

Tab. 4: Correlation matrix of ALQ and leadership styles

4 Discussion and Conclusions

The results of the pilot investigation point to the following factors – first of all, they indicate that higher levels of self-awareness are presented by people who prefer transformational leadership. Higher levels of self-awareness are also indicated by people inclined towards systemic, visionary, situational, and democratic leadership. The results of the survey show that people preferring systemic leadership show higher values of moral and ethical qualities and have a stronger preference for autonomy in their decision-making.

Interesting results are also suggested by the effect of structuring respondents by generational "affiliation" (Generation X, Y, and Z). Generation X appears to be the generation with the least constraints in terms of the ability to be led and in relation to preferences for leadership styles, including the bureaucratic style. In this sense, it differs significantly from Generation Z respondents, where the willingness to be led is less intense, and the risk of less ability to cooperate with leaders preferring styles dominated by the command and control aspect can be assumed. In this context, we can suppose that, for example, bureaucratic leadership is unacceptable to them and may even provoke active resistance. The observation that bureaucratic leadership loses its "attractiveness" in the terms of willingness to accept it, as the generation gets younger can also be considered significant. In other words, the younger the generation, the stronger this trend becomes (Jakavonyte-Staškuvienė, Strazdauskienė, 2023; Terenteva et al., 2023; Crampton et al., 2009; Avolio et al., 2004).

The investigation also points to a shrinking surface area, and if we understand surface area as adaptive or adjustment potential in terms of the willingness and ability to adapt and follow leaders, it is evident that as age decreases, this comfort zone becomes smaller, i.e., each younger generation will be more rigid and radical or intolerant, with a stronger preference for autonomy-supportive environments and leadership styles. If we take into account the whole investigation, it turns out that potentially promising leadership trends in relation to the gradual generational change of employees and with regard to the characteristic features of the development of the modern environment are transformational, systemic, visionary, situational and democratic leadership (Avolio, Gardner, 2005; Brown, Treviño, 2006).

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CHANGES AND ISSUES IN HEALTHCARE SECTOR UNDER THE INFLUENCE OF INDUSTRY 4.0 CONCEPT

^aMARCEL KORDOŠ, ^bPAULÍNA SROVNALÍKOVÁ

Alexander Dubček University in Trenčín, Študentská 2, 911 50 Trenčín, Slovak Republic

Email: ^amarcel.kordos@muni.sk, ^bpaulina.srovnalikova@muni.sk

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Abstract: This research paper is devoted to the issue of changes in healthcare sector under the influence of Industry 4.0. The main objective of the research is to estimate the impact of Industry 4.0 concept elements in healthcare sector on national economy and social environment within the prospects and synergies for bigger use of Industry 4.0 technologies in healthcare sector. The paper draws attention to identifying the synergies brought about by Industry 4.0 in the healthcare sector. To reach this goal, methods such as analysis, comparison, synthesis, and logical deduction are to be used. The results have shown that healthcare sector is a sector that is most in need of the technological convergence regarding the factors of digitization, automation, robotics that have brought the possibility of greater and more transparent data connectivity.

Keywords: surgical robotics, automation and digitization processes, eHealth program Comprehensive Hospital Information Systems, Electronic Health Record, artificial intelligence

1 Introduction

Currently, the issue of the fourth industrial revolution, called "Industry 4.0", in terms of new technology and innovation enhancement is coming to the fore. Slovak and global not only industry, but also the healthcare sector is experiencing the fourth industrial revolution in the form of the Industry 4.0 concept implementation. Companies and organizations are interested in digitization, robotics and automation of their operations to improve workplace conditions and the quality of services provided. This transformation brings about an increase in the potential and productivity of work, as it is innovation that drives the development of businesses, institutions, and the economy. However, companies in industry and organizations in healthcare sector are currently feeling the impact of the economic recession (post-pandemic period, energy crisis, inflationary threats). Opportunities to increase competitiveness through Industry 4.0 are many, from low-cost adjustments and process optimization with quick payback, to the implementation of more detailed analysis of existing data, to training and human resource development. Every innovation and advance technology bring a potential competitive advantage.

By 2050, the world will be home to 10 milliard people, and two in five of those people will be 60 years old or older, including 434 million over the age of 80. This combination of population growth and demographic change will seriously accelerate the challenges we face in delivering healthcare, with global healthcare spending expected to reach 13% of GDP in OECD countries by 2050 (OECD, 2023). Scientific and technological progress is a necessary manifestation in all directions of human activity. In the field of healthcare, this issue is much more sensitive as it directly concerns the care of a person's physical and mental health. The aim of advancing technological progress in this area is to transform health and healthcare so that there is the greatest possible integration, resulting in significantly improved outcomes in all areas of healthcare sector. There are creating new systems where automation and robotics are expected to deliver a more precise approach to patients. In order to understand the scale of scientific and technological breakthroughs and their potential impact on healthcare delivery, it is necessary to identify where particularly fundamental and decisive changes will occur. The healthcare sector is the sector most in need of this technological convergence of the factors regarding the Fourth Industrial Revolution. Industry 4.0 can be understood as a set of technological practices arising from the physical, biological, and digital world that seeks to improve the efficiency and effectiveness of health processes and professionals with guidelines for transforming data into useful

and accessible information. Systematically and qualitatively describing the benefits of Industry 4.0 in terms of healthcare sector is a complex task. In healthcare, digital technologies can bring significant changes in healthcare delivery.

Based on the mentioned challenges above, this paper will draw attention to identifying the synergies brought about by Industry 4.0 in the healthcare sector. Therefore, the main goal of the research in the presented paper, is based on the analysis of the Industry 4.0 concept elements regarding the healthcare sector to reveal and estimate the effect of Industry 4.0 concept elements highlighting automation, digitization, and robotics issues implemented in healthcare sector on national economy and social environment within the prospects for bigger use of Industry 4.0 technologies in healthcare sector. Within the stated objective the outline of the paper is as follows. Based on the literature review the issues of Industry 4.0 concept elements are to be illustrated. Within the main part of the paper the issues such as implementing surgical robotics in healthcare, ABB robotic solutions for hospitals of the future, opportunities for the informatics and digitization processes application in healthcare, opportunities for using AI in healthcare will be analyzed and followed by the discussion and conclusions.

2 Theoretical Background and Literature Review

According to Hlušková (2020) Industry 4.0 is a new philosophy that brings society-wide change and affects a wide range of areas from industry through technical standardization, security, education system, legal framework, science and research to the labor market healthcare sector, and social system. The transition from the isolated use of computer and robotic support for production or administrative tasks is technologically enabled by rapid developments in the fields of communication technologies, information and computer technologies, cybernetics and artificial intelligence methods and techniques, and new materials and biotechnologies. The current trend towards automation and data exchange, reflecting rapid technological and technical progress, can also be defined as deep industrial integration through information technology and the associated data processing. Staněk, Pauhofová (2019) argue that the 4.0 revolution is already underway by connecting the internet, things, services and people and the associated huge volume of data generated, moving towards machine-to-machine, human-to-machine, or human-to-human communication. Industry 4.0 will transform manufacturing from stand-alone automated units to fully integrated automated and continuously optimized production environments. New global networks will emerge based on the interconnection of production facilities into cyber-physical systems. These will be the building blocks of smart factories being able to exchange information independently, trigger necessary actions in response to current conditions and control each other independently (Fifeková, Nemcová, 2016). This revolution is about connecting IT and the dominance of robots that will transform manufacturing, bringing in an increased degree of both qualitative and quantitative just-in-time method. This would help shift European companies' production from Asia back to Europe to be more flexible. Digitization will enable the production of products tailored to the customer, and there will be an increased emphasis on product quality. Industry 4.0 is also characterized by interoperability, hence the interconnection and communication of machines, equipment, sensors and people, the sharing of information and virtualization. It will also enable decentralized decision making, allowing cyber and physical systems to make simple decisions and become more autonomous (Technický Týdeník, 2022). Industry 4.0 is already focusing on the complete digitization of all physical assets and their integration into digital ecosystems that will communicate to each other, including partners along the value chain. Within this chain, there is a vertical integration, which represents digitization in the direction from product development, through purchasing, to production, logistics and services. This data will

be supported by augmented reality and optimized by the information systems infrastructure within the manufacturing company. Horizontal integration will link internal operations to suppliers, customers, and other key partners in the value chain. This includes technologies ranging from tracking and traceability devices, to integrated real-time planning, to the execution of specific activities (Dobrosotskiy, et al. 2019).

Müller, Kiel (2018) argue that Industry 4.0 is based on the boom of digitization, robotics, automation and is one of the priorities for the development of industry not only in Europe, but also in the world. It is a necessary reindustrialization - the spread of highly productive industrial production methods to all areas of the economy and the economy. The basic components are the processes of digitization, automation, and robotics. Digitization is an Industry 4.0 concept built on the fact that people, machines, equipment, logistics systems and products can directly communicate and cooperate with each other. Everything is moving towards complete networking. Enterprises are thus moving towards the so-called Smart Factory, which is built on the following technologies. CPS (Cyber-Physical Systems) - these are the basis for the Internet of Things (IoT) and, together with Internet services, form the basis of Industry 4.0. These are physical devices complemented by embedded devices for digital data collection, distribution and processing and are interconnected online. Communication via CPS is called M2M (Machine to Machine). IoS (Internet of Services) is an infrastructure that uses the Internet as a medium for offering and selling services (eBay, Amazon). IoS provides the business and technical basis for advanced business models focused on the provision and use of services (MESR, 2023). According to Mura (2019) Product Lifecycle Management systems (PLM) allows to integrate processes, data, people inside the company, but also suppliers or customers. Digital twin processes data from physical objects, which are used to optimize them. It has three main parts: physical objects in real space, digital objects in virtual space, and the data and information link that ties real and virtual products together. Physical production only occurs when the product is ready digitally, i.e., a digital model is created, it is restimulated, and the processes are optimized. Exponential technologies are technologies that support rapid growth in efficiency and productivity (nanotechnologies, biotechnologies, 3D printing, sensing, ICT and mobile technologies, artificial intelligence, advanced robotics or drones). The smart factory operates in an intelligent environment and the result is an intelligent product that meets the individual needs and requirements of the customer and is at the same time profitable for the manufacturer. Robotics has long been a reality in industry and is an important factor in gaining competitiveness (for example, the shortage of skilled workers today is one of the biggest problems that can be solved by robotics). Automation means production based on the principle of interconnecting all components via the Internet with a cyber superstructure that allows full automation of the entire process; the superstructure computer system can manage and optimise the entire production process based on data, while also solving unpredictable problems (Ahmad, Seman, 2019).

Bilan, et al. (2019) state the Industry 4.0 era will need people with technical training and analytical skills. New positions will need creative employees with specialist skills and innovative engineering. The value of these skills to people will also change. People with low educational attainment and low digital skills will be particularly at risk as well as people over 50 years of age. Occupations that consist of routine activities are particularly at risk. These will be clerks processing numerical data, administrative workers, drivers in transport and logistics, employees in services, sales, construction and so on. Occupations that will not be replaced by automation and digitization are the least at risk such as jobs in education, healthcare and creative fields. The most in demand will be specialists in databases and networks, managers in information and communication technologies, software, and computer application developers. Preference will be given to staff with a high degree of apprenticeship who will be encouraged to continue their development. These staff will need to learn new skills in order to be continuously employable. Healthcare

organizations and institutions will also need to move towards a learning organization and put knowledge management into practice (Sidak, Hajnisova, Fabus, 2021).

3 The Goal and Research Methodology

The research task is focused on the analysis of the problematic aspects of healthcare sector development in Slovak economy in terms of the robotics and automation issues affected by Industry 4.0 elements implementation and to find out their consequences. The research will be focused on exploring the Slovak healthcare sector analyses and the further development under the Industry 4.0 conditions. To put in other words, the main goal of this paper is by means of analysis, comparative analysis methods followed by logical deduction to figure out the potential benefits for Slovak national economy and society development coming out of Industry 4.0 aspects being implemented in Slovak healthcare sector. The paper is focused on problematic aspect analyses such as the current status of Slovak healthcare sector environment and possibilities to implement Industry 4.0 technologies like robotics and communication and information technologies into Slovak hospitals. The issue is to figure out whether and to what measure the robotics, new technologies might affect the services enhancement along with the labor force supply adaptability to it. For the most objective assessment of the changes being awaited by Slovak healthcare sector due to the implementation of Industry 4.0,

To accomplish this goal, methods such as analysis, comparison, synthesis, and logical deduction are to be used. Subsequently the analysis will lead to synthesis and prognosis by means of abstraction method eliminating the less important factors in order to set general statements and opinions. Data and for the analysis are withdrawn from the respected and reliable institutions such as OECD and WHO have achieved high recognition from the governments of countries being evaluated as well as businesses, and therefore they are considered as authoritative sources in this field.

4 Results and Findings

Over the past century, various advances have been made across different aspects of health and healthcare. From the promotion of antiseptic surgery and the use of antibiotics in the early 20th century to genome editing in the 2000s, new disciplines and innovations have led to substantial improvements in healthcare delivery and outcomes. Specific examples of breakthroughs include, for example, in biotechnology: genetic engineering, regenerative medicine and stem cells, immunotherapy, precision medicine. Nanotechnology and IoT have also contributed to improving human health and quality of life, as have advanced medical devices such as 3D printing, robotics, and drones. Last but certainly not least, virtual reality and better diagnostics. The rapid pace of progress in science and technology in the fourth industrial revolution has significant implications for health and medicine. Advances in areas such as genetics, genetic engineering, precision medicine and others are leading to new diagnostic and therapeutic modalities that offer the possibility of curing diseases, reducing suffering, prolonging lives, and other benefits. The opportunities to incorporate intelligent IT tools in healthcare are also continuously growing. Data can be used in the diagnosis and subsequent therapy of patients, which is what smart healthcare is all about.

4.1 Implementing Surgical Robotics in Healthcare

According to Matusčáková (2018) one of the areas, where robots are used in the field of medicine, is surgery. Surgical robotics is the direct or indirect use of robotics in the planning and execution of surgical procedures. Surgical robotics can be divided into two main categories. The first consists of surgical workplaces where robots directly perform surgical procedures. This category can be divided into two subcategories. In the first, the robot directly performs the surgery pre-planned by the surgeon, who has entered it into the robot's control system in the form of a program. The robot is then supervised by a human

during the surgical procedure. The second subcategory is telepresence robotic surgery. Here, the robot is controlled remotely by a human. The operation does not need to be programmed in advance, the surgeon performs the individual actions using controllers, the data is transmitted via a control system to the robot, and it directly performs the procedure. Telepresence robotics makes it possible to control the robot so that the surgeon may or may not be present in the operating room. The second major category of surgical robotics is robot-assisted surgery. Here, robots are not directly involved in modifying the human body, but perform other surgery-related activities, such as administering instruments. Surgical procedures performed by robots need to be well planned and flawlessly executed. Different methods are used to allow two- and three-dimensional views of the human body and its interior. 2D techniques include ultrasonography, fluoroscopy, or X-ray radiography. 3D imaging techniques used include computed tomography - CT - and magnetic resonance imaging - MRI. The next step is surgical planning, which is done by viewing models of the human body constructed using visualization techniques. The surgeon plans the procedure so that the healthy tissue is damaged as little as possible when the diseased tissue is accessed and modified. Robotic surgery has found its place in fields such as orthopedics, neurology, urology, or cardiology. In orthopedics, robots are used to acquire pre-operative data, as well as to assist in operations and perform the surgery by itself. Examples include total hip replacements, knee components or soft tissue replacements, with robots primarily assisting in the precise placement of tissues and replacements. In the field of neurosurgery, the limitations of humans in terms of being able to use their hands to perform procedures at microscopic scales have become a significant argument in favor of deploying robots. At the same time, neurosurgery has become the first area of medicine where robots have become established for their precision (Technicom, 2019; Vasylieva et al. 2020).

Senhance, a robotic surgical assistant developed by TransEnterix, allows surgeons to control surgical instruments via computer. *Senhance* is controlled by the surgeon from a platform resembling the cockpit of an airplane. The visual connection is mediated by a special 3D interface that captures the body part being operated on in detail. The doctor thus remotely controls up to three robotic arms equipped with different surgical instruments. *Robear* is a caregiver robot developed by RIKEN-SRK in Japan. The robot assists especially elderly patients in moving and transferring. *Robear* is strong enough to lift patients out of bed, but also gentle and gentle enough to provide support when they are sitting in wheelchairs. In 2016, Professor Robert MacLaren successfully performed the world's first robotic eye surgery at the John Radcliffe Hospital in Oxford. He used a remote-controlled robot to lift micro-membranes directly into the retina at the back of the eye. Scientists at Imperial College London developed a 'smart' knife to identify tumor tissue in 2013. The knife tests the tissue during surgery and instantly provides information on whether the tissue contains cancer cells. During surgery, this information is continuously communicated to the surgeon, greatly speeding up the analysis of biological tissue and allowing virtually all cancerous cells to be removed. *The da Vinci Surgical System* is a surgical robot that combines the expert work of a surgeon with state-of-the-art technologies - micromechanics, three-dimensional visualization and computer control. It was designed by the American company Intuitive Surgical. It is controlled by the surgeon and allows to perform very sensitive surgical interventions and procedures. Today it is used in hospitals around the world. Robotic-assisted surgery is a common method abroad, as it allows for more precise surgeries with faster wound healing. In Slovakia, however, this technology is used in only one medical facility so far. The F.D. Roosevelt University Hospital in Banská Bystrica has been using the *Da Vinci* robotic system since 2011. It is most often used in urology. As Vladimír Baláž, the head of the Robotic Assisted Surgery Centre at the hospital explains, the robot consists of a control console, an operating console, and a video console, it can control instruments beyond the limits of the human hand and can enlarge the image as needed (Izakovičová. 2019; SOVA Digital, 2018; WEC, 2016; Barto, 2020).

4.2 ABB Robotic Solutions for Hospitals of the Future

ABB has analyzed a range of manual processes currently carried out in medical laboratories and estimates that 50% more tests could be performed annually by implementing automation. Robots performing repetitive processes would relieve highly specialized staff and also help to eliminate the potential overloading of the musculoskeletal and nervous systems that often arises in humans from repetitive tasks and inappropriate body postures. These are collaborative robots that do not require any protective fences or special spaces. They can move and work in close proximity to humans, and assist with every day, routine activities. It is estimated that by 2025, their use will increase in medical environments, with nearly 60,000 non-surgical robots working there. The intention to gradually introduce automation into the medical environment was currently announced by a leader in technological innovation - ABB in cooperation with the largest medical science center in the world - Texas Medical Center (TMC) in Houston. This huge city within a city at the forefront of life sciences development treats 10 million patients annually, performs more than 180,000 surgeries, 25,000 deliveries and handles more than 750,000 emergency admissions. When opened in October 2019, the new center at TMC is ABB's first dedicated medical research center. Houston is a hub for global medical technology research, making TMC an ideal location for ABB's new medical technology research facility. On an area of 500 m² is located an automated laboratory and robotic "training" equipment. Running a site that sees 10 million patients a year requires efficiency and precision and standardized processes. TMC is precisely pursuing this goal by incorporating ABB's research center for the development of robotic solutions in healthcare into its group of strategic partnerships. ABB is a leading technology company with a comprehensive offering for the digital industry. With more than 130 years of history, today ABB is writing the future of industrial digitization with its four businesses: electrification, industrial automation, drives and robotics, and automation, supported by the ABB Ability™ common digital platform. The ABB Group employs around 147,000 people in more than 100 countries around the world. It has been operating in Slovakia since 1991 and is currently represented in seven cities in Slovakia. It employs a total of just over 280 people. The ABB Group in Slovakia also includes the Pucaro company in Piešťany (MHRSR, 2020; Hoerbst, et al. 2011; Soltes, Gavurova, 2014).

4.3 Opportunities for the Informatics and Digitization Processes Application in Healthcare

Healthcare informatization will improve the quality of communication between several actors: the patient, cross-border healthcare staff, home healthcare staff, laboratories, pharmacies and other healthcare institutions. The level of healthcare is thus naturally increased and self-regulated, thus creating a certain self-control of the system. The whole system can be controlled and analyzed in this way, in terms of the flow of finances, costs, revenues and the performance of the parties involved. The main mission of the *eHealth program* is to support and streamline the healthcare system based on the use of information and communication technologies. In Slovakia, the *eHealth* implementation program is documented in the strategy proposed by the Ministry of Health of Slovak Republic since 2008. *eHealth* is a relatively new term, which is part of the structure of the program documents of the Operational Program for the Informatization of Society (Architectural Framework) and e-Government. *eHealth*'s main objective is to create a National Health Portal, launch a pilot application of the Citizen's Electronic Health Book, ePrescription, eAllocation, and to create the basic structures for the integration of information systems with the national e-Health system. The Electronic Health Service - Extension of Functionality and Scope of Services (EES-RFaRS) aims to consolidate information on the drug and knowledge database, to ensure security mechanisms, especially with regard to the protection of personal data, and to provide new functionalities for electronic services. A particular advantage of the system is the fact that, following the introduction of e-Health innovations, insurers can quickly access

patient data as well as reliable service providers (Durdisová, 2005; E-zdravotnictvo, 2020).

According to Holčík (2010), the function of *Comprehensive Hospital Information Systems (CHIS)* is to ensure the processing of patient data as well as its processing and storage. The CHIS is designed to be able to track specific activities of several components at the same time (doctor, nurse, laboratory, pharmacy), but at the same time to protect this data and make it accessible only to authorized persons. Thus, its components are outpatient clinics, inpatient wards, laboratories, pharmacies, operations, as well as administrative and managerial or director's offices. These workplaces are also linked to higher systems such as the Ministry of Health. The CHIS is based on modules that communicate and operate together. These models or subsystems can be divided into two categories, those that are directly related to health care and those that create structures in the administration. Firstly, healthcare: central patient reception, clinical information system (CIS) - for the various types of hospital wards (inpatient ward module, outpatient department module, operating theatre module, etc.), and, secondly, for the various types of hospital wards (inpatient ward module, outpatient department module, operating theatre module, etc.), which can be set up in the same way, laboratory information systems (LIS) - for different types of laboratories, nursing process, radiology information system (RIS), pharmacy information system (LeIS), modules of specialized instrument systems, examinations and monitoring of patient's condition, module of health care reporting for health insurance companies, module of statistics reporting for the National Centre of Health Information (NCZI), module of catering service for patients (patient meals), patient ordering system (also on-line: MY SOLP). The second component consists of administration (administration, management): accounting module, invoicing module, personnel and payroll module, asset registration module, catering module for employees (employee meals), inventory module, building maintenance module, maintenance of equipment and devices module, energy management module, reporting module for insurance companies (Stanek, 2005; European Commission, 2023).

An *Electronic Health Record (EHR)* is a collection of electronically stored health information in digital form. This information and recordings can be shared with other systems through a network connection. Thus, the EHR contains data such as medical history, diagnoses, results, medications, as well as personal information about a particular patient such as his or her geographic location, height, weight age or general health. The EHR is supposed to increase the productivity of eHealth professionals and reduce the administrative burden or the cost of manpower and performance of the function, it has to support research and clinical systems, it has to be capable of developing future technologies in healthcare and it has to increase the level of security and protection of eHealth data. The EHR is supposed to be an information channel for the connection between patients, institutions, insurers, healthcare providers in general. *OpenEHR* was created as a result of the development of an open, interoperable software platform for healthcare, of which electronic health records are a core component. OpenEHR thus integrates the requirements of healthcare institutions and clinical research. OpenEHR has mainly applications in information and communication systems in healthcare as such. The main focus of the OpenEHR project is on the computerization of healthcare based on electronic health records and EHR systems. The main priority is the possibility of storing information, i.e., all medical histories, diagnoses, results or services that are provided (NHIC, 2019; WHO, 2023).

The main objective of *ePrescribing, eMedication and eDispensing* is to provide healthcare professionals with an efficient mechanism for prescribing medicines. Thus, the physician receives comprehensive information about possible contradictions, diseases, predispositions or drug allergies. In this way, the number of documents issued by the doctor should be reduced. The paper prescription will thus be replaced by an electronic version and the patient will not receive paper

documents in his or her hands, thus preventing their misuse or damage. This ensures a more efficient and at any time verifiable communication between patient, doctor, and pharmacist. ePrescription is thus in short, an application by which medicines are transcribed on an electronic basis, which means that the instructions for the medicine, its dosage, information on the use of the medicine are written down and the patient can collect them in another country participating in the eHealth project. With the help of the information system, which is part of the National Health Information System, it is possible to look into the patient's records, namely his electronic health book, and check the medicines he is using, find possible contraindications and thus determine more effective treatment. Doctor enters the details of the new diagnosis as well as the recommended medicines in a card that can be retrieved at any time, thus simplifying the patient's path to the information. The patient who requests the medication recommended by the doctor at the pharmacy does not go with a prescription; the pharmacist will view his report through the information system. If the medicine is not available, the pharmacist can replace it with another medicine, just from a different manufacturer. Thus, the doctor is informed about the change of the medicine and the information is stored in the database (MHSR, 2017; E-zdravotnictvo, 2020).

4.4 Aspects for using AI in Healthcare

According to Szabo et al. (2020) and Rozsa, et al. (2022), artificial intelligence (AI) is a subfield of computer science that deals with the development of machines that exhibit human-like intelligence. This intelligence can be achieved using a method called machine learning. It is immediately apparent that the method in question has great applications in healthcare, specifically in diagnostics. Judging whether something is pathological requires an expert trained over the years, and even that expert will often seek the opinion of a colleague. Already today, artificial intelligence is beating experienced doctors in making a diagnosis. Artificial intelligence, specifically its subfield of natural language processing (NLP), is already assisting doctors in studying vast medical materials, identifying correlations, and recommending the most appropriate treatment. While a human can read a single page in a few minutes, artificial intelligence can absorb knowledge from an entire library in that time. In the future, it will be common for a doctor to consult his or her treatment procedure online with artificial intelligence. Artificial intelligence can help doctors or healthcare professionals wherever their decision-making is contingent: for example, with expertly correct diagnosis in the light of the latest medical knowledge and based on the correct, complete, and timely evaluation of large amounts of data and information. Large volumes of this data can be converted into so-called structured data that AI can read and predict possible courses of action (using neural network technologies, machine learning, expert systems, as well as genetic algorithms). Examples of the use of artificial intelligence for medical purposes are as follows. Automated systems for reading and recognizing outputs from modalities such as MRI, CT, or ECG with similar or better accuracy than doctors. In the use of natural language processing technologies - to assist software in analyzing a patient's condition based on their speech, particularly in the field of psychological and psychiatric examinations (e.g., better recognition of depression - a diagnosis that now threatens an increasing number of mentally active people). Sequencing the human genome, i.e., 'reading' genes, the cost of which is falling at an enormous rate every year. Based on gene data, it is possible to predict a patient's disease or to specify cancer treatment more precisely (WEF, 2019).

Examples of the AI usage for administrative purposes in healthcare sector include applying machine learning to the pre-packaging of medicines or medical devices, which can improve their availability in more remote parts of the country. Identifying anomalies in prescribing medicines using data from health insurance companies. At the hospital level, better use of data will be able to contribute to better shift planning, space, or bed utilization. The benefits of applying AI in healthcare, taking into account more data than any individual physician can collect and

process, will enable more effective disease prevention, personalized treatment for the patient, less healthcare waste, less congestion for healthcare staff, and accessibility to healthcare (Designworldc, 2021).

5 Discussion

Based on the displayed results, the impact of the changes brought about by the implementation of Industry 4.0 elements in the healthcare sector will impact healthcare, and the future of healthcare is impacted by a number of aspects. The integration of healthcare and social services is seen by many as a key solution to relieve the burden on it - this effort has a rational justification. With around one third of the elderly population in Europe suffering from chronic health conditions, any solution to reduce fragmentation of services, reduce duplication and rationally allocate diminishing resources in a more efficient way can only be seen as a positive one. Hospitals that are able to cooperate with social care institutions gain a more comprehensive view of the patient, not to mention time and administrative savings. For patients, the seamless contact between health and social care means that their situation is understood, and their needs are met. Most importantly, however, thanks to the effective exchange of information between the two sectors, healthcare can finally be transformed from corrective to preventive and meet the challenges of the 21st century.

Generally speaking, the use of technology and improved information management is also important in this process. For example, electronic prescribing reduces errors by up to 50 per cent compared to manual prescribing. If we have complete electronic documentation and other patient information, we can immediately electronically check a patient's prescription for the amount of medication ordered, its contraindications with other medications or allergies, and the patient's clinical condition. By and large, pressure is also increasing to standardize roles and job tasks to streamline services to patients and to share the work to reduce spending and forced redundancies of medical staff. While these challenges increase the efficiency of healthcare delivery, personalization of patients and services needs to be integrated to achieve the full potential of industrialization. These areas are, of course, interlinked by information. On top of that, more and more information is being collected about patients in hospitals, and sophisticated technologies are beginning to be used not only in major, but also in smaller and local healthcare facilities. It can be assumed that sharing information over the internet in the form of documents, images and medical reports is becoming more and more common (NCZI, 2018). Another factor to consider is that tracking systems and software reduce waiting times and allow the doctor to know the exact location of the patient at any time. Some hospitals use portable wireless tablets to track patients, while others use tracking systems after leaving the hospital to help patients with follow-up treatment. Some patients are starting to track and record their medical history to get a clear picture of their healthcare. At the same time, data sharing and shared workflow systems give patients an increased level of control, for example, in obtaining an alternative solution from another provider if they are not satisfied with the proposed treatment.

When it comes to industrial robots and automation, they are moving beyond the factory floor and into healthcare and science. We can think of innovation in healthcare as anything that can be delivered to a patient in medicine at the level of available science, and we can see the result as a change in quality of life for the better. In the world today, there are robots that can assist with interventions, administer medication to patients, help patients with rehabilitation, provide information based on shared files. Another fundamental change is online services. People no longer must go to a medical facility when they want to prescribe medication. They owe this to electronic prescribing of medicines (Tupá, 2020; Svec, Mura, 2020). We consider these electronic services to be very efficient, as people do not have to waste time in waiting rooms and do not have to expose themselves to possible infection by sick patients. As a consequence, these applications have a significant impact on reducing the number of

errors and problems with prescriptions, eliminating duplication, which has a positive impact on time preservation. Among other things, communication will be unified between several entities, including health insurance companies, which can check back on services and devices or medicines that have been provided. This will make it possible to produce statistical studies on diseases and the use of over-the-counter medicines (for example, the amount of antibiotics used over a certain period of time).

Another point worth noting, harnessing the power of the Internet to integrate medical devices, medical data and IT systems gives physicians powerful tools to improve patient outcomes and reduce their hospital stays. The essence of SMART medical devices is adding intelligence to the traditional medical device system, encompassing all sources and locations of patient information. It is about leveraging dynamic and engaging facilities to serve personalized patient needs and identifying opportunities for staff and facility administrators that differentiate treatment options as well as where care is delivered (Zajac, Pazitny, Marcincin, 2004; Grmanova, Ivanova, 2021). It is important to recognize that the healthcare sector is part of the digital revolution. This is why the term 'Health Care 4.0' is beginning to appear more and more frequently. In addition, the changes and trends coming for those working in the healthcare sector, such as doctors or nursing staff, are becoming more and more evident and noticeable. Today, the healthcare sector is already using advanced digital devices to accelerate the progress and development of medicine while ensuring economic efficiency.

6 Conclusion

On the whole, the results and findings suggest that the impact of the Fourth Industrial Revolution on health and healthcare sector is crucial. It can be concluded that Industry 4.0 is affecting all areas of the economy to a large extent. In case of healthcare, the revolution has brought significant changes in terms of robotics, digitization, the Internet of Things, artificial intelligence, and big data. The fundamental change is made by digitization that brought in healthcare sector the possibility of greater and more transparent data connectivity so that systems can communicate to each other, saving not only time and money, but also providing better healthcare, as many diseases are diagnosed and treated early.

The paper dealt with the issue of changes in healthcare sector under the influence of Industry 4.0. Taking everything into account, the implementation of new technologies and technological knowledge into healthcare sector is very important for humanity. The rapid transformation of an ageing population and society over the next few decades will require the deployment of better tools and technologies that will enable us to lead longer, healthier and more productive lives while achieving better access to care for the population. As a conclusion we can say that the healthcare sector should take its lead from the industrial sector, where digital technologies are arriving precisely within the concept of Industry 4.0. Digital technology is indeed ahead of the curve, but in different intensities in terms of personal and commercial areas. All things considered; the healthcare sector has long been using the latest digital devices that are designed to accelerate healthcare services and medical advances on one hand and ensure economic efficiency and cost pressure on the other hand.

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ASSESSMENT OF SHARED E-SCOOTER SAFETY

^aVILÉM KOVAČ, ^bZUZANA ROWLAND, ^cTEREZA MATASOVÁ

^a*Technical university of Košice, Faculty of Mining, Ecology, Process Control and Geotechnologies, Slovakia,*

^b*Institute of Technology and Business in České Budějovice
Research department of economics and natural resources
management*

^c*Pan-European University, Business and management, Praha
email: ^akovac@mail.vstecb.cz, ^arowland@mail.vstecb.cz,
^amatasova@mail.vstecb.cz*

Abstract: The goal of the paper was to assess the safety of riding shared e-scooters and determine the causes of accidents involving them. Primary data for the research were obtained through a combination of quantitative and qualitative content analysis based on deep learning by analysing data from the WoS database entered into the VOSviewer system. A quantitative observation method was used to determine the number of shared e-scooter users who do not use safety equipment such as helmets. The data obtained were processed using the Wilcoxon test designed to test the homogeneity of two random samples in the univariate case. The observation of shared e-scooter users and social networks of e-scooter service providers showed that safety equipment is not adequately used; in addition, the users often do not know the traffic rules and often violate them. Of the 256 monitored cases of using shared e-scooters, none of the users wore a safety helmet. It can thus be concluded that it is necessary to promote the rules of the safe use of shared e-scooters. Further research could focus on proposing a methodology for assessing traffic accidents involving e-scooters and a general overview of recommendations for e-scooter safe use.

Keywords: Micro-mobility, shared mobility, public transport, electric scooters, injury, wearing helmet

1 Introduction

The concept of Smart City (SC) as a tool to improve the citizens' quality of life is gaining importance in the agenda of policymakers (Vochozka & Machová, 2018). SC sustainable transport requires smart and environmentally friendly technical solutions (Ghorbanzadeh et al., 2019). An approach to respond to this call is the transition to shared mobility services (X. Li et al., 2018). Based on these new modes of transport and the development of information and communication technologies, the concept of "mobility as a service" has emerged recently (Wells et al., 2021), which offers "door-to-door" service without the necessity of owning a private vehicle (Lu et al., 2018). The new modes of transport, such as shared vehicles or shared rides are beginning to increase their market share at the expense of traditional modes of transport, e.g., automobiles, public transport, and taxi services (Moreno et al., 2018). New types of mobility, including e-scooters and e-bikes, have been recently introduced in many towns in the world (Bielinski & Wazna, 2020). E-scooters have become a popular kind of micro-mobility for urban transportation, offering its users a flexible option for mass first and last-mile travel (Yang et al., 2020). The use of e-scooters would also significantly reduce the production of CO₂ (Jung & Koo, 2018). Urban transport planners see e-scooters as an alternative to individual car transport, while the public has welcomed the idea of using e-scooters with both enthusiasm and skepticism, as towns have to face unforeseen consequences such as irresponsible riding, cluttering, or vandalism (Gosling, 2020). Short-term rental scooters owned and operated by start-up companies inundated towns almost overnight, promising a disruption to the urban transportation status quo (McKenzie, 2019). The use of e-scooters could reduce local congestion; however, drivers of two-wheeled motor vehicles are very prone to a high risk of injury on roads (Allem & Majmundar, 2019). From the very beginning of the use of e-scooters, an increasing number of patients have been hospitalized due to injuries caused by riding e-scooters (Moftakhar et al., 2021). For this reason, the use of e-scooters raises concerns related to the safety of their riders and pedestrians. The most common causes of these accidents include ignorance of traffic rules and the recklessness of e-scooter riders (Trivedi et al., 2019). Another frequent cause of many accidents involving e-scooters is alcohol or other drugs that negatively affect the reactions of e-scooter users while riding (Kobayashi et al., 2019), and such accidents then result in hospital overcrowding caused by the hospitalization of such

patients (Bloom et al., 2021). E-scooter riders most often come to hospitals with contusions, abrasions, lacerations, fractures, and head injuries; patients often even need surgery (Brownson et al., 2019)

2 Research goal

The goal of the paper is to assess the safety of riding shared e-scooters and to identify the causes of traffic accidents involving them.

By answering research questions, it will be possible to determine how operators of shared e-scooters try to avoid traffic accidents involving shared e-scooters that they rent to users. The important thing is to find out whether e-scooter users that ride them on roads know all the traffic rules.

RQ1: What are the current measures taken by shared e-scooter providers to prevent accidents involving shared e-scooters

Next, it is necessary to determine how the operators of shared e-scooters try to protect the health of their users in the case of an accident involving e-scooters they rent to users, or whether the measures indicated by the operators are sufficient.

RQ2: What are the current measures to reduce the health impact in accidents involving e-scooters? Is safety equipment used rather by men or women?

Finally, it is necessary to determine the ways to reduce the number of traffic accidents involving e-scooters and caused by e-scooter users. This is related also to the formulation of general recommendations for e-scooter users.

RQ3: How can accidents involving shared e-scooters be avoided?

3 Literature research

Shared mobility includes the systems of public transport and shared mobility supporting first and last-mile travel, which means mobility as a service, and stimulation of further demand for travelling by other than private means of transport (Meng et al., 2020). Increased accessibility of these newly emerging types of mobility, which includes dockless systems of bike and e-scooter sharing, provides citizens, workers, and town visitors with a comfortable alternative to more established modes of transport (Gehrke et al., 2022). In the last decade, there has been a rapid increase in shared mobility (Hu & Creutzig, 2022), which could improve the economic situation of marginalized groups of people, as well as reduce CO₂ emissions (Leat et al., 2022). However, (Turon et al., 2020) state that the increase in shared mobility services has brought various types of problems not occurring or occurring to a limited extent within the traditional systems. Therefore, shared mobility services are analysed from various perspectives, of which safety-related issues are particularly important for both users and operators (Turon et al., 2019). A similar conclusion was made by (Gehrke et al., 2022), who point to the need for policies supporting shared mobility services through provisions for secure infrastructure (Davis et al., 2020). Developing methodologies for measuring and evaluating the impacts of shared mobility including the safety of its use has thus become essential for city authorities (Kearney et al., 2019). Road safety is one of the major problems in transport system management. Safety analyses usually assess the frequency of accidents and the effects of measures taken on the number of accidents. The emergence of new mobility types makes safety assessment more challenging, as there are usually not enough data and the effects of these services on demand and the effectiveness of the broader network are not completely known (Feizi et al., 2022). Similarly to (Turon et al., 2019), a growing number of researchers are dealing with the concept of various safety and security issues in relation to shared mobility,

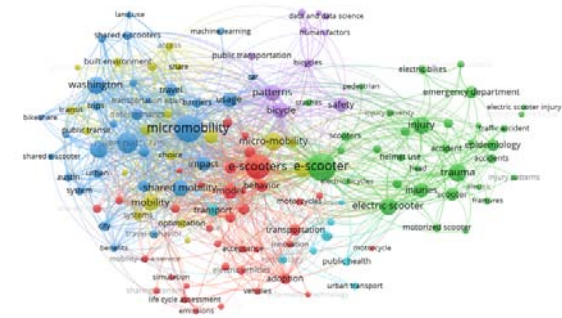
such as bike, car, or e-scooter sharing. The popularity of e-scooters is given by their availability, accessibility, and low price (Sikka et al., 2019). (Caspi et al., 2020) argue that people use e-scooters almost exclusively in city centres, regardless of the wealth of districts, although less wealthy areas showing a high rate of using e-scooters are those with the large student populations, which indicates that this means of transport is commonly used by students and young people. Along with the increased use of e-scooters, there is also a growing number of accidents involving e-scooters. However, little is known about the risk factors for accidents and injuries related to e-scooter use (Tian et al., 2022). (Siebert et al., 2021) state that there has been only limited research on the relationship between the ergonomics and safe use of e-scooters and it is unclear whether e-scooter riders are aware of prevailing e-scooter-related regulations and whether they adhere to the existing traffic rules. The authors identified several problems that cause accidents involving shared e-scooters: intoxication by alcohol or other drugs, ignorance of traffic rules, riders' brake unreadiness, lack of knowledge about the scooter braking system, and two riders riding one scooter. (Haworth et al., 2021) presented the results of their research, claiming that more than 90 % of e-scooters, about 50 % of shared bikes, and approx. 25 % of private bikes were ridden on the footpath and about 40 % of them were within 1-m distance of at least one pedestrian. Research conducted by (Kobayashi et al., 2019) focused on the factor of intoxication in the users of e-scooters. About 79 % of patients were tested for alcohol; 48 % had blood alcohol levels > 80 mg/dl. A urine toxicology test was performed in 60 % of the patients, with 52 % of them being positively tested. (Bekhit et al., 2020) even state that more than 25 % of accidents involving e-scooters are directly caused by riding while drunk. Compared to other modes of transport, such as cars and bicycles, the safety of e-scooters is significantly understudied. In addition to individual e-scooter riders' behaviour (e.g., swinging, hard braking, etc.), it is also necessary to focus on safety problems resulting from increased vibration, changes in speed, and proximity to surrounding objects (Ma et al., 2021). If e-scooter riders rode the same distance in km as drivers of motor vehicles, there would be about 254 times more injuries than in the case of accidents involving motor vehicles (Salas-Nino, 2022). Research conducted by (Moftakhar et al., 2021) dealt with the number of accidents involving e-scooters. They found that a higher number of accidents are recorded in the late afternoon and peak at 8 pm. However, the highest number of patients (39.2 %) were injured in the early evening hours (between 8 pm and 1:59 am), with the most threatened group being young adults (aged 19-39). Shared e-scooter users do not use protective equipment and therefore more injuries occur (Beck et al., 2020). According to (Ma et al., 2021) 95 % of shared e-scooter users did not wear a safety helmet, which resulted in hospitalization due to minor head injuries or concussions, exceptionally even ICH or skull fractures. While the probability of suffering a head injury and hospitalization of persons injured on e-bikes was 17.1 %, the percentage was nearly three times higher for e-scooters (Siebert et al., 2021). For e-scooter injuries, the average hospitalization time is 3 days and often causes unnecessary occupation of hospital beds (Uluk et al., 2020). The authors also stated that 42 % of the hospitalized did not have a driving licence. Similarly, (Kim et al., 2021) point to the need to educate e-scooter riders on the importance of wearing protective equipment such as helmets and on the traffic rules.

Primary data are obtained using many methods (Lim et al., 2018). Information obtained through observation represent important data for evaluation and research (Bian et al., 2019). Observation is an empirical research method used for quantitative and qualitative research focused on understanding the real-time development of behaviour and interaction, which makes it particularly significant for examining the processes associated with the generation and adoption of creative ideas (Katz-Buonincontro & Anderson, 2020). Indirect observation largely involves the analysis of textual material obtained either indirectly from the transcriptions of audio recordings of verbal behaviour in a natural setting (e.g., conversations, group discussions), or directly from posts (e.g., statuses, tweets,

forums) (Teresa Anguera et al., 2018). (Izquierdo & Anguera, 2021) mention the need for choosing between qualitative and quantitative observation methods. recommend combining both methods to achieve the best results. For examining a large number of processes and events to focus on specific information rather than collect detailed information, the most suitable method is quantitative observation (Zyphur & Pierides, 2020).

Relevant materials for content analysis will be selected using deep learning, which provided useful tools for processing and analysis of large data volumes (Zhao et al., 2019). Another method used is extracting accurate information from raw sensor data (H. Li et al., 2018). (Wang et al., 2019) use methods based on deep learning in sensor-based activities. However, (Guo et al., 2021) state that deep learning is still in its infancy due to the unique challenges data processing pose. As an alternative, they propose the use of neural networks, which can be more suitable in certain situations. Figure 1 shows a suitable combination of keywords through visualization of networks using deep learning.

Figure 1. Keywords visualization (Source: Autor via VOSviewer)



(Source: Autor via VOSviewer)

A suitable method for data processing can be content analysis (Miwa, 2022). When collecting data using content analysis, this method has similar features to the observation method (Thaker et al., 2018). According to (Dehnavieh et al., 2019), content analysis can be used for data processing. Qualitative content analysis is a research methodology conducted either through induction or deduction. The inductive approach uses data collected at the beginning of the research, while in the case of deductive, i.e. directed approach, research is based on existing theories to set up information that guides the research (Kibiswa, 2019). (Lindgren et al., 2020) state that qualitative content analysis and other "standardized" methods are sometimes considered technical tools used for basic, superficial, and simple text classification and their results may lack sufficient accuracy. (Ham et al., 2019) also state that the accuracy of the results of quantitative analysis depends on the analysts' experience. (Cavalcanti et al., 2020) use content analysis to find recurrent key events related to the given issue.

To answer research hypotheses, statistical methods of data processing will be used. Calculating confidence interval for the population mean enables determining how the mean of the obtained samples differs from the actual population mean (Ivkovic & Rajic, 2021). This method is used by many researchers to determine how representative the obtained results are for the whole population. The creation of the interval is based on statistical methods and includes both the upper and lower limit (Julious, 2019). Statistical analyses include the determination of the so-called significance level, as the higher the confidence of the selected analysis, the more accurate its results are, i.e., inverse proportionality applies. In general, significance level expresses the probability of rejecting the null hypothesis – the lower the significance level, the more difficult it will be to reject the null hypothesis. A frequently asked question related to quantitative research is how to compare two samples that include a combination of paired and unpaired observation (Derrick & White, 2022). Ignoring the violation of the error normality assumption is a mistake that may cause

inconsistencies in the analysis of variance results. To verify whether this assumption is met or violated, normality tests, such as the Shapiro-Wilk test can be used (de Souza et al., 2023). Shapiro-Wilk tests confirm the normality of distribution. When examining the reproducibility of experiments in different test samples, it is suitable to use two-sample tests (Shan, 2022). The Wilcoxon test is designed to test the homogeneity of two random samples in the univariate case (Liu et al., 2022). It is a rank-based method for one- and two-sample tests when the univariate data are not normally distributed (Ouyang et al., 2022).

For the purposes of this paper, content analysis and conventional quantitative observation will be used to collect primary data. The findings will be analysed using quantitative content analysis, which will enable answering all formulated research questions.

3 Materials and methods

The data necessary for answering the first research question will be obtained through qualitative content analysis of documentation provided by the Regional Directorate of the Traffic Police of the Czech Republic, specifically from České Budějovice, a town situated in the centre of Europe with nearly 100 000 inhabitants. Currently, the police does not keep records of accidents involving e-scooters but it is able to provide information about all traffic accidents involving either Bolt or Lime, which are the only companies providing shared e-scooters in České Budějovice. The data provided for the period from 1 January 2021 to 1 December 2022 monitor the following aspects of accidents: date, time, the severity of injury of the shared e-scooter user, and the name of the company that provided the given e-scooter. This enables determining the time and period in which this type of accident occurs. Along with content analysis of documents provided by the police, the method of deep learning will be used to obtain data from articles on the topic of "electric scooter injuries, e-scooter accidents, and e-scooters" published between 1 January 2018 and 1 December 2022. Based on the keywords, articles dealing with this issue will be selected where the reasons why accidents involving e-scooters occur will be sought for. The results will be used as the basis for answering the third research question.

To answer the second research question, it is necessary to determine what injuries typically occur in accidents involving shared e-scooters. Qualitative content analysis will be used to analyse published research available via Web of Science, which focuses on the issue of accidents involving e-scooters using deep learning, on the aforementioned topics of "electric scooter injuries, e-scooter accidents, and e-scooter". The data will identify the most common consequences of accidents happening to e-scooter users, which enables making recommendations for the providers on which direction they should take to ensure greater user safety. This research question will also use the observation method. Quantitative observation will be used to monitor the users of shared e-scooters in České Budějovice from 1 November 2022 to 1 December 2022 between 10:00 and 4:00 with the aim to determine the level of user protection, especially the number of shared e-scooter users that wear safety helmets and other protective features, which may result in better protection of their health, the gender classification of users, and the length of the ride. As in the case of the previous research question, there will be used the data provided by the Police of the Czech Republic, which keeps records of the severity of injuries in accidents involving shared e-scooters. To determine whether the providers sufficiently protect the health of the users of their e-scooters, Instagram profiles of companies providing shared e-scooters will be monitored. Here, quantitative content analysis will be used to monitor the number of users wearing safety helmets between 1 January 2021 and 1 December 2022 and whether users are encouraged by the providers to use protective equipment. Another subject of observation will be whether users follow the established rules they should follow when riding e-scooters.

For the purposes of the paper, hypothesis H1 is formulated as follows: women spend less time riding shared e-scooters without wearing safety helmets compared to men.

The third research question concerns the formulation of general recommendations to avoid accidents involving e-scooters. Here, the most important data is information provided by the police about accidents that occurred in the last year and the analysis of their causes, places and time of these accidents. Based on these findings, measures to prevent the occurrence of this type of accident will be formulated. This information thus represents primary data that will be examined using qualitative content analysis. Subsequently, the research will use the data obtained through the previous research questions, especially the general recommendations provided by individual companies operating shared e-scooters. Here, qualitative content analysis will be used to examine the development of the rules of companies Bolt, Lime, and Uber between 1 January 2020 and 1 December 2022. The obtained data will represent the main risk factors e-riders encountered in the last two years, and along with other data, future possible threats will be predicted.

Next, it is necessary to analyse the obtained quantitative and qualitative variables. To calculate two-sided confidence interval for the population mean, first the mean \bar{x} for the sample size and standard deviation for the sample set $s_{(x)}$, as the population standard deviation is not known. The quantile of the standard normal distribution is determined at the number of observed users n . The significance level α , which reflects the error rate of the test, is determined according to the number n . The above variables enable calculating two-sided confidence interval for the population mean μ , limited by upper and lower interval (G_d and G_h)

The calculation is based on the following formula (Abu-Shawiesh & Saghir, 2019):

$$\bar{x} - \left[u_{\left(1 - \frac{\alpha}{2}\right)} * \frac{s_{(x)}}{\sqrt{n}} \right] \leq \mu \leq \bar{x} + \left[u_{\left(1 + \frac{\alpha}{2}\right)} * \frac{s_{(x)}}{\sqrt{n}} \right],$$

where:

\bar{x} – arithmetic mean of the length of the journeys [min];

$s_{(x)}$ – standard deviation for the selected sample set [min];

α – level of significance [%];

n – number of samples;

μ – two-sided confidence interval for the population mean [min];

To verify the assumption of data normality, it is necessary to confirm or reject the formulated null hypothesis, for which alternative hypothesis needs to be formulated as well. First, it is necessary to determine the significance level α , which is usually determined at 5 %.

H₀: men and women spend equal amount of time riding shared e-scooters without wearing safety helmets

H₁: women spend less time riding shared e-scooters without wearing safety helmets.

Observations are converted into normal variables. The Shapiro-Wilk test is then used to confirm the assumption of data normality, which enables confirming or rejecting the null hypothesis. After applying the Shapiro-Wilk test for confirming the assumption of data normality, a p-value is obtained, which needs to be compared with the significance level α . If the resulting p-value of the Shapiro-Wilk test is greater than α , the null hypothesis is not rejected. If the p-value of the Shapiro-Wilk test is less than α , the null hypothesis is rejected.

To verify the rejection of the H₀ and if the assumption of data normality is not met, another tool needs to be applied, such as a final non-parametric two-samples Wilcoxon test. After entering the obtained data into the computing system, the p-value for the Wilcoxon test is calculated, which is also compared with the significance level α . The same rule applies for the Wilcoxon as for the Shapiro-Wilk test, i.e., if the resulting p-value is greater

than α , the null hypothesis is not rejected; if the p-value is less than α , the null hypothesis is rejected and the alternative hypothesis is accepted.

4 Results

E-scooter sharing companies naturally try to ensure the safest possible rides for users. However, they often do not take adequate measures to make the use of e-scooters safer. Therefore, there were successively analysed applications for renting scooters, companies' social networks and websites targeted at Czech users, where the operators of e-scooter sharing services should encourage the users to ride safely. The first analysed company was Bolt, which encourages users to ride safely the first time they use the app but it is not possible to look at the rules of using e-scooters later. However, Bolt provides clear basic information on the rules of using e-scooters on its website. The website of Lime only refers to the mobile app where e-scooters can be unlocked. Here, when using the app for the first time, the user must agree to the terms of use, which also briefly and in small letters mentions the safety rules of riding the e-scooter. As for Uber, on its website, the company only states that it also operates shared e-scooters and bikes, but provides a direct link to the application which is rather focused on providing taxi and other Uber services. For better illustration, Table 1 shows the rules and recommendations presented on the websites and mobile apps of the aforementioned companies.

Table 1. Rules and recommendations for using e-scooters provided by individual companies

	Bolt	Lime	Uber
Prohibited riding under the influence of alcohol	yes	yes	yes
Prohibited tandem riding	yes	yes	yes
Recommended riding on cycle paths	yes	yes	no
Prohibited riding on pavements	no	no	no
Compliance with traffic rules	yes	yes	yes
Recommended checking the functionality of the e-scooter	yes	yes	no
Recommended familiarization with the e-scooter	yes	yes	no
Recommended use of a safety helmet	yes	yes	yes
Introduction of slow zones	yes	yes	yes

(Source: mobile apps and websites of Uber, Bolt, Lime)

Monitoring the consequences of accidents is an important factor in understanding this issue. For this purpose, conducted research has been analysed. Research conducted by Genc Yavuz et al. (2022) focused on a total of 70 patients who were provided treatment in the emergency department. The consequences of traffic accidents involving e-scooters were superficial soft-tissue injuries (45.7 %; n=32) and head injuries (40 %; n = 28). Based on medical examination performed, orthopedic fractures and sprains were found in 18.5 % (n = 13) of patients, and jaw fractures in 11.4 % (n = 8). About 4.3 % (n = 3) of patients had worn a safety helmet. Brownson et al. (2019) conducted research on a similar topic, with the following findings: 180 patients were admitted to the hospital due to the consequences of a traffic accident involving e-scooters. The median hospital stay length was 4.0 hours, and the interquartile range (IQR) was 18.4 hours. The most common injuries included contusions, abrasions, and lacerations (65.6 %), fractures (41.7 %), and head injuries (17.2 %). Every fifth patient (22.2 %) needed surgery. Only three patients (1.6 %) had worn a safety helmet. Of all patients treated, 23.3 % had consumed alcohol; of all patients with a head injury, 41.9 % had consumed alcohol.

A controversial topic is primarily wearing safety helmets, which should be the most important safety factor when riding e-scooters. For this reason, the content analysis method was used to monitor posts on the Instagram profiles of individual companies that provide the services of shared e-scooters between 1 January 2021 and 1 December 2022. These companies include

Bird, which is widely represented all over the world, especially in the USA, and Bolt and Lime, which provide their services directly in České Budějovice. Within the analysis of social networks, attention was paid to e-scooter users that were wearing safety helmets in posted photos and videos. In addition to monitoring wearing helmets, there were also monitored persons using mobile phones while riding e-scooters. The results of the analysis are shown in Table 2.

Table 2. Results of Instagram profiles' analysis concerning the e-scooter users' health protection

Company	Number of users wearing helmet	Number of users not wearing helmet	Number of users using a mobile phone
Bird	13	119	5
Lime	53	82	6
Bolt	10	8	0

(Source: Author)

In parallel with the analysis of the companies' profiles on social networks, primary data were collected using the method of observation when the population sample of shared e-scooter users in the České Budějovice district was observed between 1 November 2022 and 1 December 2022. Currently, there are more than 11,000 users of shared e-scooters registered in České Budějovice, for whom 261 e-scooters are available for rent. The subject of the investigation was the use of safety equipment, mainly safety helmets, the gender of the users, and the length of the ride. In total, there were monitored 256 e-scooter users, who used the services of Bolt or Lime. Of the 256 monitored cases (statistical units), no e-scooter user was wearing a safety helmet or using safety equipment.

In the period 1 January 2022 – 1 December 2022, the Regional Directorate of the Traffic Police in the South Bohemian region recorded a total of 10 accidents involving shared e-scooters. The data are presented in Table 3. These are distorted data since the information is inaccurate. No source, whether the database of the Czech Police, scientific articles, etc., provides information on the precise number of accidents involving e-scooters in the last year. The actual number is assumed to be several times higher but it is not easily obtained due to the fact that the majority of accidents occurring are not dealt with by the Police of the Czech Republic, since there are mostly superficial injuries only when the intervention of the emergency services is not necessary and users do not have to seek medical help. Such accidents are thus not recorded in any database.

Table 3. Overview of traffic accidents involving shared e-scooters in České Budějovice

Date	Time	Injury severity	Damage [in thousand CZK]	Company
3 May 2022	22:34	1 person injured	0	Lime
5 May 2022	21:45	1 person injured	10	Bolt
20 May 2022	18:48	1 person injured	32	Bolt
2 June 2022	1:56	1 person injured	25	Lime
15 June 2022	16:21	1 person injured	0	Bolt
15 June 2022	23:06	1 person injured	0	Bolt
2 July 2022	19:59	1 person injured	0	Bolt
13 July 2022	21:28	1 person injured	0	Lime
28 July 2022	23:49	1 person injured	5	Bolt
29 July 2022	0:36	1 person injured	5	Bolt

(Source: Policie ČR)

For effective prevention, it is necessary to identify the causes of these accidents. Usually, it is a combination of several causes. The content analysis performed within research conducted on this issue, the following findings were obtained: Kobayashi et al. (2019) deal with the intoxication of e-scooter users where 79 % were tested for alcohol, with a blood alcohol level of 48 % of them being > 80 mg/dl. Bekhit et al. (2020) even argue that more than 25 % of accidents involving e-scooters are directly caused by riding while drunk. Another major cause is fast rides. Beck et al. (2020) conducted a study that included 149 accidents involving e-scooters and found that 60 % of the accidents were caused by fast rides, loss of balance, and failure to adapt the speed to the surface of the road. Due to this, e-scooter users most often experience accidents caused by slipping on a non-standard road surface, such as cobblestones, tram tracks, pedestrian crossings, and horizontal road markings. According to Meyer et al. (2022), these were causes of more than 7 % of the total 356 cases analysed. Another cause of accidents is the use of one e-scooter by two and more users. According to a survey conducted by Bolt, 15 % of all rides recorded in 2021 were those where one e-scooter was ridden by more than one user. According to their findings, another common cause of accidents is that users do not fully concentrate on riding, e.g., due to using their mobile phones or listening to music, which negatively affects concentration and distorts auditory perception.

Calculation of two-sided confidence interval for the population mean:

$$\bar{x} = 11.75 \text{ [min];}$$

$$s_{(\bar{x})} = 5.67899966 \text{ [min];}$$

$$\alpha = 5 \text{ [%];}$$

$$n = 256;$$

11.0543 [min] $\leq \mu \leq$ 12.44468 [min] with 95% confidence and a deviation of 2.5 % for both upper and lower interval.

The formulated null hypothesis H_0 was rejected on the basis of the results of the Shapiro-Wilk test of the assumption of normality since the resulting p-value is 0.000000:

$$\alpha = 5 \text{ [%];}$$

$$p\text{-value} < \alpha = H_0 \text{ is rejected;}$$

$$0.0000 < 0.05;$$

Where:

$$\alpha = \text{significance level;}$$

The assumption of data normality is thus not met. Therefore, a final non-parametric two-sample Wilcoxon test must be applied

using the calculation software. The resulting p-value was 0.009248.

$$0.009248 < \alpha;$$

The alternative hypothesis assuming that the average time spent without wearing a safety helmet is the same for both men and women can thus be accepted.

5 Discussion

RQ1: What are the current measures taken by shared e-scooter providers to prevent accidents involving shared e-scooters?

The issue of accidents involving shared e-scooters should be dealt with mainly by companies providing this service. However, such companies are primarily interested in increasing their profit rather than the safety of e-scooter users. When examining individual recommendations provided by such companies with the aim to increase the safety of e-scooter users, three companies were analysed, namely Uber, Lime, and Bolt. In this respect, Bolt was rated the best. On its website, Bolt offers e-scooter riders the Bolt Scooter School where both potential and current users can learn how to use e-scooter safely, familiarize themselves with the scooter and with the rules and regulations that need to be followed when riding e-scooters. This training can be seen also in the application used for renting e-scooters but only when using it for the first time; later, it is not possible. This is considered a significant shortcoming given that the application is the only tool necessary for using this service. On its website, Lime provides a link to the mobile app where, unlike Bolt, it is possible to see the rules and conditions of using e-scooters anytime. Of the companies analysed, Uber is rated the worst, as compared to the above companies, it mentions the same rules but ignores the recommendations that could reduce the number of accidents involving e-scooters, such as the recommendation to check the functionality of the brakes, familiarization of users with the e-scooters, and the recommendation to ride on cycle paths. None of the companies analysed informs the users about the prohibition of riding on pavements, although this regulation is stipulated in the road traffic rules of the Czech Republic. However, this regulation is significantly absent in the conditions of the use of shared e-scooters. Due to the users' unawareness of this regulation, there is a greater number of accidents caused by collisions between e-scooter riders and pedestrians.

RQ2: What are the current measures to reduce the health impact in accidents involving e-scooters? Is safety equipment used rather by men or women?

The operation of these services includes efforts to reduce the number of accidents as well as the adoption of measures to mitigate the consequences of accidents involving shared e-scooters. When analysing individual consequences, it was found that more than 60 % of patients that were given treatment in the emergency department had superficial soft-tissue injuries, while more than 40 % had suffered a head injury. Head injury was evaluated as one of the most serious injuries associated with e-scooter riding, despite of the fact it can be easily eliminated by wearing safety helmets. The use of safety helmets and other safety equipment should be promoted even by the providers of these services. When analysing the profiles of Lime, Bird, and Bolt on social networks, Bolt was again rated the best one as only in 44 % of cases, it showed users who were not wearing helmets and not even once did it show a user using a mobile phone while riding an e-scooter. As for Lime, 60 % of its posts showed e-scooter riders who were not wearing safety helmets and 6 e-scooter riders who used mobile phones. Of the three analysed companies, Bird shows the highest number of posts with e-scooter users not wearing safety helmets (nearly in 90 % of cases). The formulated hypothesis H_1 was fully confirmed. Within the monitored period, not a single e-scooter user was seen wearing a safety helmet. On the basis of the calculated average length of riding without a safety helmet for men and women, men were proven to spend longer time riding e-scooter without a helmet. The wearing of safety helmets and other

protective equipment when riding e-scooters is not sufficiently promoted, unlike e.g. in the case of cycling, although proportionally, three times more e-scooter users than cyclists need treatment in the emergency department (Arbel et al., 2022). The analysed companies providing shared e-scooters ignore a substantial part of the Czech legislation, namely the obligation of cyclists (a category that includes also e-scooter users) to wear safety helmets. None of the analysed shared e-scooter providers informs the users about this obligation, although they set the minimum age for using e-scooters at 16 years. E-scooter users thus not only endanger their health but also violate the laws of the Czech Republic.

RQ3: How can accidents involving shared e-scooters be avoided?

As there are many causes of accidents involving e-scooters, it is not possible to formulate a simple recommendation that would reduce the number of accidents involving both shared and private e-scooters. If all e-scooter-related accidents and falls were recorded, it would be possible to set speed limits in the e-scooter system in places where accidents often occur in the same way that speed limits are set e.g. in the case of cars. Speed is one of the main causes of accidents and e-scooter providers are beginning to realize this fact gradually. Therefore, in recent years, they started to implement such measures in places with a large concentration of people. However, these places are often pedestrian zones where, with only a few exceptions, bicycles and e-scooters are prohibited, and the providers of shared e-scooters do not inform the users about this fact. A large number of accidents, including those involving e-scooters, are caused by alcohol or drugs. This problem has been addressed in transport from the very beginning of the automotive industry, and unfortunately, e-scooters are no exception, mainly due to their availability in town centres, where there are a lot of bars and pubs. The users often prefer using e-scooters to waiting for night bus lines or taxis and then they often break the law by riding e-scooters under the influence of alcohol. Nevertheless, the solution to this problem is not in the hands of e-scooter providers but rather in the hands of the authorities that control compliance with the law. The police do not deal with e-scooter users and cyclists to the same extent as e.g. with car drivers. If this category was paid greater attention to, along with the enforcement of penalties, e-scooter users would be more careful not to ride them under the influence of alcohol. Another common cause of accidents is tandem riding. This problem can be solved by e-scooter providers as well as the responsible authorities since tandem riding cannot be overlooked and can thus be easily fined. From the side of e-scooter providers, tandem riding can easily be prevented by system modification. Since e-scooters are smart devices, it is possible to calculate the approximate weight of the user on the basis of the power expended to achieve a desired speed, and based on this calculation, tandem riding can easily be detected. E-scooters are designed to carry a maximum weight of 100 kg. If this weight is exceeded, which usually occurs in the case of tandem riding, the e-scooter can be automatically deactivated. Bolt has already developed software that should be able to monitor the weight of the rider that uses the e-scooter and is thus able to detect whether another rider started to use the scooter. At that point, the scooter should be deactivated.

6 Conclusion

The goal of the paper was to assess the safety of riding shared e-scooters and to identify the causes of accidents involving them. The goal of the paper was thus fully met.

E-scooters have recently become a discussed topic in larger towns' town halls. It shall be noted that the main safety issues concerning e-scooters are not e-scooters as such but their users. If all the rules set by e-scooter providers were followed, the number of accidents would be significantly reduced. Currently, e-scooter users are the reason why the number of accidents involving e-scooters is three times higher than in the case of bicycles. The cornerstone for ensuring safety is training aimed at

making users familiar with e-scooters and the regulations they must follow. Such training should be provided by e-scooter rental companies to users when they use e-scooters for the first time, and companies should ensure that they successfully complete the training.

The safety of riding e-scooters does not depend only on preventing the occurrence of accidents, but also on the use of both active and passive safety features. If shared e-scooter riders started to use safety helmets, the passive safety of users would significantly increase, since according to the research results, 40 % of e-scooter riders treated after an accident had suffered a head injury. This recommendation cannot be targeted at one gender only as the unwillingness to wear safety helmets applies to all users. The wearing of safety helmets is not sufficiently promoted by the analysed companies on their social network profiles, although they recommend their wearing. For example, on its social network profile, the company Bird shows only 10 % of users that are wearing safety helmets. Users should be recommended by e-scooter providers to use these passive safety features. Also, it is necessary to make users familiar with the legislation concerning the mandatory wearing of safety helmets in a given country.

Relevant authorities should focus on the reduction of the number of accidents involving e-scooters and the enforcement of penalties associated with this type of mobility. In the Czech Republic, e-scooter users are classified as drivers subject to the same regulations as passenger car drivers, and offences and crimes can be easily fined and enforced. According to the research conducted by Bekhit et al. (2020), about 40 % of patients treated after an accident involving e-scooters had been under the influence of alcohol, which is in the Czech Republic punishable by a fine of \$ 1,000 – 2,000 and possible revocation of a driving licence for a period 6 – 12 months. Similarly, companies providing e-scooters should also participate in the reduction of the number of accidents in several ways, e.g. by monitoring places with a frequent occurrence of accidents and limiting the speed in these places, mapping pedestrian zones where e-scooters are prohibited because of a large concentration of pedestrians or other obstacles, which may result in a lower number of accidents in these risky areas, deactivation of e-scooters in these areas, and modification of software used in e-scooters that would prevent tandem riding.

There are two major limitations to this research. From the perspective of reducing the number of accidents, it is an absence of keeping records of accidents involving e-scooters in the legislation of the Czech Republic. Due to this, it is not possible to sufficiently analyse this type of accidents in order to obtain primary data, which would enable a better understanding of this issue and propose suitable measures to reduce the number of accidents. The limitation in terms of passive safety features is the unavailability of safety helmets. Although it is known that head injuries are of common occurrence, there is no system created to ensure sufficient safety features for users of these shared mobility means, such as e-scooters, bicycles, and e-bikes.

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CRISIS SITUATIONS IN THE WORLD AND THEIR IMPACT ON STOCK MARKET INVESTMENTS

^aROBERT KUCHAR, ^bJIŘÍ KUČERA, ^cLENKA DIVOKÁ

*Institute of Technology and Business in České Budějovice,
School of Expertness and Valuation, Okružní 517/10, České
Budějovice 37001, Czech Republic*
email: ^akuchar@mail.vstecb.cz, ^bkuceraj@mail.vstecb.cz,
^c29474@mail.vstecb.cz

Abstract: The paper examines the behavior of investors in times of economic crises when investing in the S&P 500 Index, gold and the cryptocurrency Bitcoin. The results of the descriptive analysis show that the decision-making of investors in times of economic crises is reflected in the development of the S&P 500 Index by a decrease in average annual prices, the opposite is the case with gold, where there is a significant increase in the market price in times of crisis. This means that investors in crisis situations consider gold to protect their capital. An analysis of the tightness of the relationship between the S&P 500 Index and the price of gold based on monthly data by Pearson correlation confirmed a moderate inverse relationship. The cryptocurrency Bitcoin has seen a massive increase in market value during the Covid-19 pandemic due to the shift of business to the online world. As in the case of gold, from the perspective of investors, this cryptocurrency was seen as a way of protecting their investments and, in addition, the possibility of maintaining solvency even in a period of restrictions. Bitcoin and other virtual financial instruments seem to be a suitable alternative to gold investments in the 21st century during the crisis.

Keywords: Prediction, investments, economic crises, correlation analysis

1 Introduction

The cyclicity of the economy includes periods of prosperity and periods of crisis. A period of prosperity is characterized by stable economic structures in society and a gradual increase in the wealth of all market participants. Conversely, a period of crisis is manifested by a reduction in production, an increase in unemployment and a significant reduction in investment activity. This restriction applies to investments in tangible, intangible and financial assets.

When investing in financial assets such as shares, bonds, but also, for example, popular cryptocurrencies these days, these are investments in stock markets that have a great influence on the global economic situation and are also able to reflect a possible crisis economic situation. Just like financial assets, commodity markets are also affected by the current global economic situation (Aliu et al., 2022). Investments in commodities, which include gold and other precious metals, can serve as a substitute for investments in riskier standard financial assets in a world crisis.

All financial products can be described as established in the financial world since they are freely tradable for physical persons and the evolution of their value can be monitored using time series. All financial instruments have a so-called duality that is specific to them. Positive market growth acts as a preventive measure against the risk of an economic crisis. Conversely, negative market growth increases the risk of an economic crisis. This is usually caused by speculative massification, which is influenced by the public state policies (Ion, 2021).

Economic growth, inflation and financial development are very important drivers of the economy (Clark et al., 2021). The stock market is one of the most important indicators of financial market development (Hajilee et al., 2014). Investors' interest in relevant financial information is due to the development of financial markets and the growing importance of financial instruments. Thanks to this, the importance of financial statements and financial instruments in the decision-making of individual investors continues to grow (Pawlowski, 2020). Over the past two decades, the financial world has been marked by several crisis situations that had a major impact on the behavior and decision-making of investors. In this time period, the so-called "dot-com bubble" collapsed in 2001, in the years 2007 to 2009 the world economy struggled with the effects of the financial crisis, and in the years 2020 and 2021 with the

consequences of the Covid-19 epidemic. The world economy is currently affected by the military conflict between Russia and Ukraine, which began at the beginning of 2022.

The aim of the presented contribution is to establish the existence of relationships between economic crisis situations and the behavior of investors on the stock market. To that end, we ask what the role of gold as an investment commodity in times of economic crisis is in the 21st century compared to the riskier but investor-sought after investments in the Standard & Poor's 500 (S&P 500) Index and the cryptocurrency Bitcoin.

2 Literary research

Financial development has a significant role from many perspectives. According to Gur (2022), society's norms, behaviors, beliefs, and economic preferences have been accepted as some of the most important determinants of financial development. Falk et al. (2018), however, reminds that an individual's economic preferences differ depending on the way they perceive risk, age, and level of cognitive abilities. Another important aspect that supports the development of financial markets is patience. Patience has a direct and fundamental influence on the development of stock markets. However, financial markets can be affected by many internal and external factors, such as the financial crisis (Gur, 2022). In the last two decades, the biggest economic shocks were the global financial crisis between 2007 and 2009 and the Covid-19 virus pandemic between 2020 and 2021 (Hašková & Fiala, 2019).

Slimane et al. (2017) analyzed the impact of the global financial crisis on systematic beta and the subsequent influence on investor decision-making. The variation of volatility in the financial markets was modeled using the bivariate GARCH model. An increase in systematic beta has been found to influence investor behavior and decision making. The increase in systematic beta was the denominator during the crisis for many companies that faced the financial crisis that arose at that time. In a period of global economic crisis, investors begin to understand investment risk in a different way than in a period of economic stability and begin to attach more weight to it. In the crises period, according to Guiso et al. (2008), the investor's behaviour is greatly influenced by the subjective assessment of the degree of risk and the individual approach to risk. The common state is, according to Dias et al. (2020), that stock index prices do not fully reflect available information. Archibugi et al. (2013) noted a decline in research and development investment activities during the global economic crisis. However, they state that, during the period of the global financial crisis, companies that dampen their investment activities in research and development deal with the consequences of the crisis much worse than companies that strengthen them during this period and deliver new and innovative types of goods to the market. The same results were also reached by Brzozowski et al. (2019). Zarska and Sochulakova (2020) looked at the impact of the Covid-19 pandemic on SMEs. They concluded that moving activities online was crucial for businesses. Horak et al. (2021) states that businesses in the tertiary sector have struggled with uncertainty related to the measures and their financial consequences during the Covid-19 pandemic. The most common solution to compensate for the financial loss was to lay off employees. Haluszczynski et al. (2017) evaluated the interrelationship between the returns of the S&P 500 stock index and the turbulent conditions of the global economic environment. For this, they used the Pearson correlation method. They found that the turbulent conditions of the global economic environment very significantly affect the return of the S&P 500 stock index. This result was confirmed for the period of the global economic crisis, which peaked in 2008. They propose the implementation of the Pearson correlation to predict upcoming turbulence in the economy. Vochozka et al. (2021) points out that most macroeconomic predictions depend on changes in oil

prices, which affect developments in many areas of the world economy. However, these changes are difficult to predict due to the high volatility of oil prices.

Ferreuela and Mallor (2021) dealt with the analysis of investor behavior during periods of unfavorable development of financial markets. They primarily dealt with the analysis of investor behavior during the financial crisis in 2008 and during the Covid-19 pandemic in 2020-2021. According to the results achieved, investors behaved differently on the days when the value of the given financial instruments decreased and differently on the days when the value of the given financial instruments increased. After the end of the given crisis, these fluctuations also appear, but to a lesser extent. Mason and Botelho (2021) analysed the activity of so-called angel investors during the Covid-19 pandemic. This extraordinary situation caused considerable concern among angel investors, and that is why at the beginning of it they very significantly dampened their investment activities. Subsequently, when the pandemic receded, their investment activity increased again. Currently, the investment activity of angel investors is at a higher level than before the Covid-19 pandemic. According to Palma-Ruiz et al. (2020), the social responsibility of the company is important in times of economic crisis caused by the pandemic. Using descriptive analysis, they found that companies that made a financial donation during the pandemic to help fight this difficult time were better able to maintain the value of their shares and thereby contributed to the stabilization of stock indices. In a period of financial crisis caused by an extraordinary pandemic situation, every report of the re-spread of the disease has a significant impact on the world's economies. Rehan et al. (2022) conducted a correlation analysis between the number of reported positive Covid-19 cases and stock market volatility. They concluded that even during the outbreak, all stock markets on all continents were still highly volatile. The war in Ukraine showed that the European financial system is very fragile to external shocks as Aliu et al. state in (2023) where they examine the consequences of the Russian invasion of Ukraine on five Euro exchange rates.

Galvani (2020) used correlation analysis to determine the relationship between an investor's investment style and the amount of return from a given investment activity. The amount of returns generated by a particular investment style varies based on the size of the chosen investment market. Investment returns in smaller markets are more influenced by the chosen investment style than in the case of larger investment markets. Currently, the preferred investment style is diversification of investments due to the reduction of investment risk. Chen et al. (2018) used correlation analysis to find the relationship between the stock indices S&P 500, FTSE 100 and EURO STOXX 50. Based on this correlation analysis, it was revealed that in periods of uncertainty or periods of high volatility caused by political shocks, fluctuations in the mutual correlation of these stock indices occur.

Based on the literature search, it is appropriate to use descriptive and correlational analysis to find answers to the set research questions.

3 Materials and Methods

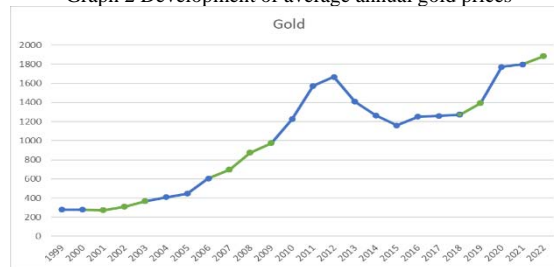
The analysis is based on data obtained from the Kurzy.cz and Patria.cz websites, etc. The data is used to determine the volatility of selected financial instruments, which are the S&P 500 Index, gold and Bitcoin. For the S&P 500 Index and gold, average monthly closing prices for the period 2000 to 2022 are used for calculation. Graphs 1 and 2 show the price development for this period.

Graph 1 Development of average annual prices of the S&P 500 Index



Source: multpl.com, 2022 [online], own source/work.

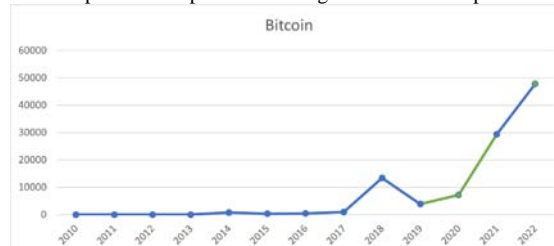
Graph 2 Development of average annual gold prices



Source: mactrotrends.net, 2022 [online], own source/work

For the statistical model of the time series, data on the price development of the cryptocurrency Bitcoin, which first appeared on the market in 2010, is also used - see graph 3.

Graph 3 Development of average annual Bitcoin prices



Source: in2013dollars.com, 2022 [online], own source/work.

All values and results are rounded to two decimal places. It is worked with the nominal price of financial instruments since the sales closing prices obtained are not adjusted for inflation. All prices are in US dollars (USD).

The research is primarily focused on the identification of correlation dependencies between gold and S&P 500 instruments in crisis conditions. Research methods are statistical procedures based on monitoring time series and their changes during the period under investigation. According to Beard et al. (2019) by time series analysis we mean a set of methods that serve to construct and select a suitable prediction model. Time series are based on historical price development. Time series models are created with the aim of describing the historical behavior of the prices of financial instruments. According to Wang et al. (2009) is based on a one-dimensional time series model in the following form:

$$y_t = f(t, E_t) \quad (1)$$

for $t = 1, 2, \dots, n$; $n \in \mathbb{N}$, where y_t corresponds to the value of the modeled indicator in the series and E_t is the value of the random component at time t . This is the most elementary time series model where real numbers are collected periodically based on the time factor and each single number is assigned a single value.

The article confronts the crisis situations of the world and the prices of the examined financial instruments. Data for the

investigated periods are compared with periods of world crises and it is determined whether the resulting situation affects the price of the selected instruments. The development of instrument prices is subsequently compared, and it is determined whether or not they are linked to each other during the crisis period.

Further, the correlation dependence between the two compared quantities is investigated through correlation analysis. Asuero et al. (2006) states that correlation can be understood as a formal positive or negative relationship between comparable phenomena. When individual variables increase or decrease, the degree of dependence between them can be identified, or independence, which does not necessarily imply causality. Correlation is measured using the correlation coefficient, which takes values from the interval $\langle -1,1 \rangle$. If the correlation coefficient approaches 0, it means that the studied quantities are independent of each other. The closer the correlation coefficient is to +1, the stronger the relationship of direct proportionality, a value closer to -1 defines the dependence of indirect proportionality. Two sets of values are available for the calculation, where gold has a value Y, and the S&P 500 Index will correspond to an value X. The Pearson correlation coefficient model will be used to achieve the result:

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (y_i - \bar{y})^2}} \quad (2)$$

which can also be expressed as

$$r = \frac{\sum_{i=1}^n x_i y_i - n \bar{x} \bar{y}}{(n-1) s_x s_y} \quad (3)$$

where

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad (4)$$

is the arithmetic mean of the prices found for the S&P 500 Index and \bar{y} is the arithmetic mean of the gold prices and

$$s_x = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2} \quad (5)$$

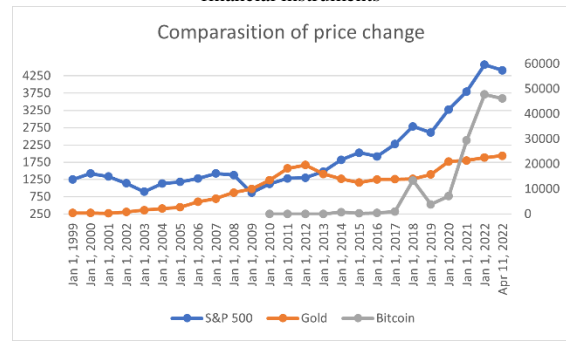
is the standard deviation of S&P 500 Index prices and \bar{y} is the standard deviation of gold prices.

4 Results

The research focuses on the 2000-2003 crisis known as the "Dot-com bubble", the 2007-2009 global economic crisis and the 2020-2021 Covid-19 crisis. On graph 1 (see the Data method section), the periods related to the crisis states of the world are marked in red. In case of price development of the S&P 500 index; every crisis resulted in a decrease in the value of this index. On graph 2 (see section Data and methods) showing the development of the gold price, periods of crisis are marked in green. There is a noticeable growth trend in the crisis periods mapped by us. In the case of Bitcoin price development, which can be assessed in the last two crisis states (see graph 3 Data and methods), the changes in these periods are shown in green. We can see from the price development that Bitcoin experienced a sharp increase especially in the crisis related to Covid-19 in 2020.

A comparison of the price development of the monitored financial instruments with the red-framed crisis states of the world in the period 1999-2022 is illustrated in graph 4.

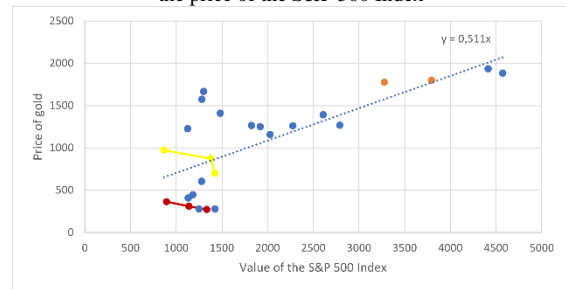
Graph 4 Development of average annual prices of monitored financial instruments



Source: Own source/work

By simple comparison from graph 4, we can see that financial instruments do not show clear signs of dependence among themselves during the examined period. A closer look at the red-framed S&P 500 and gold price values shows that gold tends to increase its market price during the crisis period, while the S&P 500 market price always falls during the examined crisis states. This indicates an indirect dependence of the price development of these instruments. A more accurate view of the degree of dependence between the development of the S&P 500 Index and the price of gold can be achieved by calculating the Pearsonv correlation (see Graph 5), which can be used when meeting the data normality test. Since the calculated p-value of 0.26 is greater than the chosen value of $\alpha = 0.05$, we do not reject the normality of the data at the 0.05 level.

Graph 5 Correlation dependence between the price of gold and the price of the S&P 500 Index

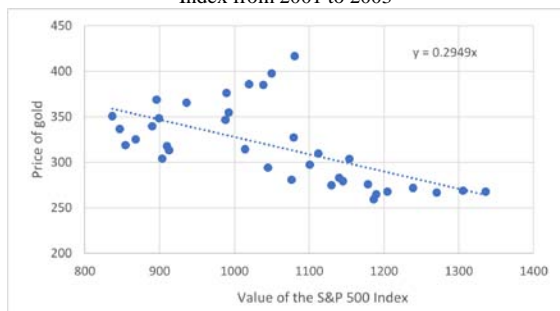


Source: Own source/work.

The correlation dependence result shows that there is a significant tightness and at the same time an average direct correlation dependence between the S&P 500 Index and gold. The result contradicts the knowledge about the crisis state of the world and the behavior of these instruments observed and shown in graph 4. For this reason, in graph 5 the red points indicating the crisis in the years 2001 to 2003, the yellow points relating to the crisis in the years 2007 to 2009 and the crisis in 2020-2021 is marked with orange points. Looking at the red and yellow course of the point values, a trend of indirect correlation dependence is evident, the position of the orange points implies a zero correlation.

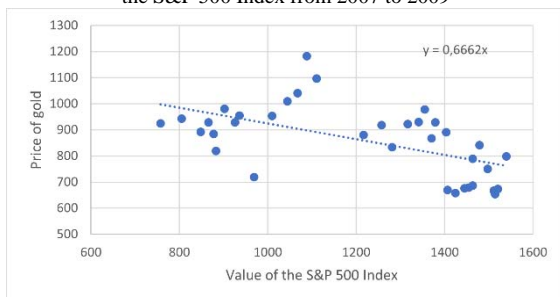
These conclusions are confirmed by a more detailed analysis of correlation dependence based on average monthly prices in the examined crisis periods.

Graph 6 Correlation between the price of gold and the S&P 500 Index from 2001 to 2003



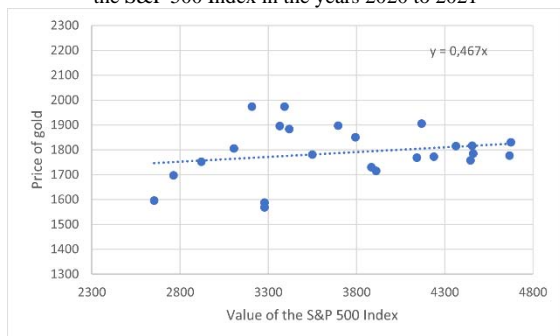
Source: Investing.com and multpl.com, 2022 [online], own source/work.

Graph 7 Correlation dependence between the price of gold and the S&P 500 Index from 2007 to 2009



Source: Investing.com and multpl.com, 2022 [online], own source/work.

Graph 8 Correlation dependence between the price of gold and the S&P 500 Index in the years 2020 to 2021



Source: Investing.com and multpl.com, 2022 [online], own source/work.

It is evident from the calculations that in the crisis of 2001-2003 and 2007-2009 there was an indirect correlation dependence of medium strength between financial instruments (see Graphs 6 and 7). In the years 2001-2003, the correlation coefficient for the confidence level of 95% reaches the value of 0.604, and for the crisis period of 2007-2009, the correlation coefficient acquires the value of 0.572. This suggests that in times of crisis, gold can act as a substitute for the S&P 500 Index. During the Covid-19 crisis (see Graph 8), there was a very low correlation between financial instruments. The correlation coefficient at the 95% confidence level reached a value of 0.217.

5 Discussion

The analyzes carried out make it possible to provide a clear answer to the question set out in the goal. Descriptive analysis proved that the behavior of investors during the economic crisis is reflected in the development of the S&P 500 Index by a decrease in average annual prices. In the context of this, Haluszczynski et al. (2017) drew attention to the adverse effect of economic crises on the price development of the S&P 500 Index and recommend continuous prediction of the development

of this index. The results of prediction methods contain information about changes in investor behavior in different economic periods. During the global economic crisis in 2007-2009, there was a sharp increase in the market price of gold, as investors saw the possibility of protecting their capital in this commodity, and thus the growth in the volume of business transactions increased its market price (Wu and Chiu, 2017). The market price of gold also increased during the Covid-19 pandemic for the same reason. The same result was also reached by Sumer and Ozorhon (2020).

A more accurate view of the degree of dependence between the development of the S&P 500 Index and the price of gold was achieved using correlation analysis, where it is evident that there is a significant tightness and direct correlation dependence between financial instruments during the observed period. This is due to the length of the time series of 23 years covering mostly non-crisis states of the world. For that reason, the correlation dependence result is biased. A closer look at the individual crises in the years 2001-2003 and 2007-2009 shows a trend of indirect correlation dependence between the value of the S&P 500 Index and the price of gold. A similar conclusion was reached by Tuysuz (2013) and Miyazaki et al. (2012). In the Covid-19 crisis, there is a very low dependence between the chosen financial instruments. According to Akhtaruzzaman et al. (2021) this was caused by the monetary and fiscal measures of central banks stimulating the economy. Regarding the possibility of predicting crises, Caballero (2010) adds that crises with a significant impact cannot be predicted. This statement is contradicted by Laborda and Olmo (2021), who state that upcoming crises can be identified using sector volatility spillovers. This was confirmed during the Covid-19 pandemic, when extreme volatility in the S&P 500 Index was likely to occur.

During the economic crisis caused by the Covid-19 pandemic, there was a massive increase in the market value of the Bitcoin cryptocurrency. As in the case of gold, this cryptocurrency was seen by investors to quickly appreciate and protect their capital. Hanifi Ayboga and Ganii (2022) attribute the rise in the price of the cryptocurrency Bitcoin mainly to the government's anti-epidemiological measures. Zhao (2022) adds to this that Bitcoin cryptocurrency is still considered a speculative asset, and even though its market price has increased during the crisis caused by the Covid-19 pandemic, it cannot be considered a safe asset in cases of long-lasting economic crises.

In the crises before the Covid-19 pandemic, gold was characterized as a safe haven. Its market price rose while share prices lost value. Investors considered it a suitable tool for portfolio diversification. An analysis of the correlation between gold and the largest stock index, the S&P 500, during the Covid-19 crisis suggests that gold's role as a substitute for the riskier investment in the S&P 500 is declining during the crisis. Drake (2022) came to a similar conclusion. Unlike past crises, when the relationship between gold returns and the S&P 500 Index was inverse, during the Covid-19 crisis it is the opposite. The generally accepted theory that gold serves as a hedge in a stock portfolio in times of crisis does not apply in this case.

6 Conclusion

In the 21st century, the crisis conditions of the world had a great influence on investment products of global dimensions. Above all, it was the bursting of the so-called "dot-com bubble" in 2001, the global financial crisis in the years 2007 to 2009, where descriptive analysis indicated that investors see gold as an opportunity to protect their capital during the crisis and turn away from investing in stocks. The analysis found that the average annual closing prices of the S&P 500 Index decline during the crisis. Gold showed the opposite trend. Descriptive analysis indicated that investors see gold as an opportunity to protect their capital in times of crisis and turn away from investing in stocks. On the contrary, during the Covid-19 crisis, both gold and the S&P 500 Index and Bitcoin gained in value.

This could indicate that investors are partly turning away from gold as a hedge for their capital.

To obtain a more accurate view of the dependence between the prices of the examined instruments, a correlation analysis was used first on the entire examined period, where a direct correlation dependence between financial instruments caused by the prevailing period of non-crisis states of the world was found. In a detailed analysis of the crises in the years 2001-2003 and 2007-2009, the correlation analysis showed that there is a trend of indirect correlation dependence between financial instruments. At the time of the Covid-19 pandemic, a very low correlation dependence between financial instruments was evident, which could have been caused by the monetary and fiscal measures of central banks. Another financial instrument examined was Bitcoin. It saw a boom especially during the Covid-19 crisis, when investors saw it as another way to protect their capital and the possibility of its rapid appreciation.

The aim of the presented contribution was to establish the existence of mutual relations between economic crisis situations and the behavior of investors on stock exchanges. Based on the results achieved, it can be deduced that the role of gold as a safe haven for investments in times of economic crises worked in the years 2001-2003 and 2007-2009, when, unlike the S&P 500 Index, its value grew. The change occurred during the Covid-19 pandemic, when there was a very low correlation between the S&P 500 and gold. This may indicate that the role of gold as a safe haven for investment in times of economic crisis in the 21st century is gradually declining and it is possible that it will be replaced by other financial instruments, which may be, for example, the speculative Bitcoin, which has seen a massive increase in value during the pandemic. The established goal of the contribution was thus fulfilled. From the point of view of investors, this contribution can serve as a basis for further research in the field of prevention or at least possible options for mitigating the effects of economic crisis situations. Bitcoin and other financial instruments, which seem to be a suitable alternative to gold investments in the crisis period of the 21st century, can also be the subject of further research.

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Primary Paper Section: A

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ATTRIBUTES OF COMMUNITY PLANNING IN THE SLOVAK REPUBLIC

^aLENKA LACHYTOVÁ, ^bMONIKA KUŠNIR SMOLNICKÁ

^{1,2}Pavol Jozef Šafárik Univerzity in Košice, Faculty of Public Administration Department of Social Studies, Popradská 66, Košice 040 11, Slovakia
email: ^alenka.lachytova@upjs.sk, ^bmonika.smolnicka@upjs.sk

This article was prepared as part of the project VEGA 1/0595/21 – Public administration interventions at the time of COVID-19 and their impact on the quality of life of citizens of selected communities.

Abstract: The analysis of the real needs of inhabitants is the subject of many studies. Currently, the provision of social services by a municipality is governed by legislative definitions, with competences specified. The legal system is set across the board and to a great extent universally, and it also depends on the experience of society and the state in this area. The modernisation of social life, the computerisation of public administration and the development of the municipality as a territorial administrative unit, however, raise questions related to the individualisation of the residents' needs and their saturation. All components are reflected in the community plan of a municipality, which is the fundamental document of a municipality when securing current social services that map the needs and requirements of citizens. The aim of the contribution is to map the specific parameters of community plans and compare them with the legislation; another attribute of the comparison is the needs of citizens based on the analysis of individual community plans. We used the following as research methods: document analysis, analysis and comparison of community plans, whereby the ratios of currently provided social services and the needs of citizens based on a direct analysis of community plans were expressed quantitatively and as a percentage, and we determined quantitative and percentage options reflecting legislation, or the Social Services Act.

Keywords: community plan, municipality, needs, request, citizen.

1 Introduction

Municipal self-government, as a territorial administrative unit, deals with tasks and contexts in the course of its development, mainly for the satisfaction of its citizens, who within that development also take part in proceedings on public matters themselves. They submit their needs and demands to the local government, which is supposed to secure all services through legislation. Among these services are social services that provide resources or solutions to individuals, families, groups or communities who are in an unfavourable social situation.

If we consider their types, social services are more or less concentrated in social service facilities. These may be in organisational competence of municipalities, as defined by law. Questions of establishing and providing social services, including through other forms defined by the law, remain with regard to quality to the local government.

The aim of the contribution is to define social services in the community planning system as a basic document of municipal self-government when providing social services. We are interested in finding out what specific social services a municipality secures and provides to its citizens, and which social services their citizens are interested in, i.e. what are the needs, specifically, the social services of the citizen. We will determine whether the municipality perceives the diversity of the age and cultural structure of its citizens, or whether it only provides social services across the board, as defined by law.

Another issue is communication in partnerships with the provision of social services, both between the municipality and the public, as well as within the organisation itself. By organisation we here mean the municipality, too, which manages human resources in the sense of citizens during its development. If the communication between the municipality and its citizens fails, as happened during the COVID-19 pandemic, when the needs of the citizens were secondary and municipalities blanketly set the direction of their citizens. We bring insight into the systemic nature and legitimacy of presenting social services in community plans as an authoritative methodology for carrying out the development of municipal self-government in the context of its development through understanding, listening and responding to the needs and demands of citizens

2 Community planning

Community planning as an organised system is directed and anchored in legislation so as to give space to the municipal territorial administration to respond to the demands and needs of its citizens. It corresponds to the demand for social services, namely in their specification. The role of municipal self-governments is to include all available resources in the community plan, through which they subsequently carry out measures that create suitable conditions for optimal living of the social life of the inhabitants.

But the question remains whether the given document truly maps needs and requirements, or whether it creates a blanket space for theoretical principles and general attributes of citizens' needs.

Social services are aimed at helping everyone – individuals, families, groups, communities, as well as the whole society – in managing life situations in the context of the biological, psychical or social essence of a person. Matulayová (2010) presents the mission of social services as helping a person, whose value is to preserve a natural place in society, but also to try to maintain it or regain it. Clearly, at the centre of interest is a person with his or her value orientation, meaning of life and social relations.

When municipalities respond to the needs of citizens in general, it is necessary to start from demographic data and the makeup of the population, and, last but not least, everything depends on financial matters, such as the income of the municipalities. These are defined by law, and an important measure is the number of inhabitants of the given municipality. Based on this, it is possible, even without research, to answer questions on the limits of social services provision. However, in the current aim, our effort is not to formulate the causes and consequences in the provision and provision of social services from a financial point of view, but to point out the importance of accepting the needs of citizens and seeking possibilities for the municipality to implement them in a specific social service.

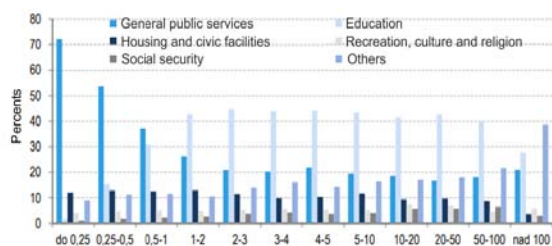
According to Černěnek, Harvan, Kubal (2017), municipalities spend the most money on general public services. The variable in the analysis of provided social services, i.e. the crucial indicator, is the number of inhabitants in the municipality and the demographic indicators. Municipalities with over a thousand residents spend the most money on education. Large amounts of resources are expended in municipalities on housing and civic amenities, which relates to small and medium-sized municipalities. The opposite occurs in larger cities, where such direction occurs to a much smaller extent. And here we come to social security, or the social area. Larger municipalities spend more in this area compared with smaller municipalities, even though smaller municipalities have a higher share of older citizens. Within this variable one would expect a high level of provision of social services, but the analysis of the mentioned authors showed the opposite. Funds freed from the performance of municipal administration can be used for appeals in the sense of social services, i.e. the establishment of facilities, with a modification of the form of social service provision. At the time the analysis was published, statistics showed that six thousand citizens were waiting for social services. A notable fact remains the aging of the population, when an increased demand from citizens arises within municipalities for facilities or social services for seniors.

From Chart 1 below, the percentage share of funds spent for securing individual areas, with respect to the number of inhabitants, expressed in the chart in thousands, can be seen.

It is specifically on this basis that community planning makes sense, because it analyses in detail and directs a municipality towards the needs of citizens, with a focus on demographic indicators. It is through the sustainability of the areas of

economy, sociability and the environment that long-term community development is possible at the local level, as Repková (2012) notes.

Chart 1 Municipal expenditures by field



Source: Datacentre in Černěno, Harvan, Kubal (2017, p. 19)

Understanding a municipality as a community, or a territory where its inhabitants live and develop productively through the form of common interests and goals, but also values, we can point to the system of social services development, because community plans are presented from this point of view. The point is that the mentioned plans are processed so that they acquire the developing tendency of the municipality itself in this area. In the area of a social community, we mean the inhabitants with regard to a common feature, in this case a certain disharmony with the environment, that is, social disadvantage. For this reason, it is necessary to appeal for specific and direct provision of social services, so that every citizen has the opportunity to realistically obtain the needed service. This means that the provision of quality accessibility to social services, and mainly to those addressed in that community, should be based on the community plan as an instrument for the direct provision of social services. There are two main procedural goals, namely: 1. mapping the needs for social services at the local level 2. comparison of needs with local resources.

These two aims, as described in the document *Analysis and Trends of the Process of Deinstitutionalisation and the Possibilities of Local Territorial Self-government from the Point of View of Providing Social Services, Employment and Remuneration* (2017), represent the coordination of municipalities in a system for providing social services, but with regard to – and this is very important – demand. The need emerges from the citizen as an individual or a family, but also group and community. Community development is also defined by the Social Services Act, which delegates competences to the municipality in the sense of creating conditions for supporting the development of social services, for direct and specific community work, as well as community rehabilitation, whose task is preventive action with regard to unfavourable social situations and solutions to local social problems. These follow from the social life and coexistence of residents or community members. With this awareness of the essence, this involves the specific engagement of citizens in decision-making and the use of resources. A prerequisite, however, is genuine knowledge of citizens' needs, identifying them, as well as the subsequent search for resource possibilities for carrying out the concept of meeting the needs of residents. The principle here is democratic and civic administration of public affairs. Specifically, the following principles must be observed with community planning:

- the principle of the triad – represents cooperation between the main stakeholders: residents, sponsors and providers,
- the principle of equality – everyone has the right to take care of public matters, i.e. the right to express him- or herself, debate and speak for oneself even without a mandate, position or mandate from an interest group; no one can be excluded and discriminated against, and their abilities, knowledge and skills should be used,

- the principle of real needs – the true state of social services is analysed and compared with normative steps, including the needs of all parties involved,
- the principle of public discussion and agreement – is a certain contract between the parties involved, which obliges each other, on the basis of democratic cooperation and public discussion, to implement the agreed activities,
- the principle of competence, feasibility and sustainability of social services – they must be adapted to the real needs of the residents, human and material resources of the local community; working groups and representatives of individual actors are professional and competent in the mentioned area; they have a clear responsibility and a position in planning, cooperation and discussion, and in concluding agreements between participants,
- the principle of cyclical repetition – as the life cycle of a community where individual phases, topics and many problems are repeated, it becomes necessary to regularly assess, update and adapt them to the needs of the local community,
- the principle of direct proportion – as a principle of process quality, quality of outputs and implementation. (Analysis and Trends of the Process of Deinstitutionalisation and the Possibilities of Local Territorial Self-government from the Point of View of Providing Social Services, Employment and Remuneration 2017: 62).

Here, however, it is important to note the degree of decentralisation, which in European countries is diverse, with several approaches to action and leadership in the context of the development of territorial self-government, and the possibilities it has, or which are determined by law. If we perceive public services in the field of health care, education or social services, significant, even striking differences can be seen in Europe. We can observe these mainly in the field of social service providers and founders, but also in financial resources and the measure of provision related to carrying out and implementing, dependently or independently of local governments, or bound to the responsibility of individual subjects. It therefore becomes necessary to follow valid legislation and the definition of scope and competences. (Social dialogue and local territorial self-government in V4 countries + Ukraine 2019).

In our conditions, other entities that operate in the field of social services can take part in community planning, whether this means the third sector, businesses, volunteers, or formal or informal entities. (Dudová, Macková 2007).

The question still arises, however, of small municipalities and their planning possibilities, with regard to the parameters mentioned above. In the state of responding to possibilities, we can here again draw attention to the partnership resulting from Act No. 448/2008 Coll. on Social Services, as amended. A positive side of establishing cooperation and partnerships in the area of social services is the direction of the citizen to create a positive relationship with the local or his or her own community.

In this way, the citizen acquires the sense of being informed, of responsibility and belonging, with the possibility of involvement in community planning. He or she becomes able to effectively take part in the possibilities, needs and offer of social services in his or her village through the aforementioned entities. (Bednárik, Repková, 2005).

The tables below document the competences of municipalities and higher territorial units in the creation of a community plan.

Table 1 Competencies of self-government for the creation of a community social services plan

Municipality (§ 80 of the Act)		
develops and approves a community social services plan in its territorial district;	seeks out natural persons who need to be provided with a social service;	provides or ensures the provision of selected types of social services, offers a financial contribution when a natural person is dependent on the help of another natural person in self-care activities and a financial contribution for the operation of a social service provided to a non-public social service provider;
Higher Territorial Units (§ 81 of the Act)		
develops and approves the concept of development of social services in its territorial district;	makes an entry in the register, announces the making of an entry in the register, issues an extract from the register, deletes it from the register, checks the level of social service provision;	provides or ensures the provision of selected types of social services, offers a financial contribution when a natural person is dependent on another natural person for self-care and a financial contribution for the operation of a social service provided to a non-public social service provider;

Source: Analysis and Trends of the Process of Deinstitutionalisation and the Possibilities of Local Territorial Self-government from the Point of View of Providing Social Services, Employment and Remuneration, 2017, p. 63).

On the basis of the above, we can define the possibilities of municipalities or local territorial self-government in meeting the needs of citizens through community planning. Attributes and objectives are defined by law and by principles. What is important is the extent to which it is possible for all municipalities, or at least most Slovak municipalities, to carry out the provision of social services according to the data obtained, in regard to the needs and demands of its residents.

2.1 Communication in community planning during the COVID-19 pandemic

A municipal self-government, in the context of transformation, monitors improvements in the quality of social services provision. During the COVID-19 pandemic, there existed two dimensions. The first monitors the quality of the social service for the recipient, where the main direction is his or her socialisation and adaptability; on the other hand, it monitors the interest of the recipient's protection by creating a safe environment, which, however, is limited by wider social contacts.

Looking at a person-client, satisfying his or her needs and building values through which that client will be able to orientate him or herself in social life, also follows community planning in a broader sense in the case of his or her protection, which was

primary during the pandemic, but also the fulfilment of qualitative prerequisites community plans.

Communication was an important part of this process in terms of passing along information to residents, clients or recipients of social services, and for municipal governments, which secured the needed measures during the pandemic and at the same time had to follow the highest interest of satisfying the demands and needs of citizens.

Municipal self-government in the system of public administration as a cooperative system is focused on the organisation of human resources management, the importance of which rests in the context of ensuring the necessary professional and expert potential in the organisation, which is dynamically intertwined with strategies and goals leading to the fulfilment of the needs of the citizen or the client within the services offered. In our case, this was interprofessional as well as interpersonal communication, with regard to the organisation's goal. On the other hand, the understanding of human resources management is focused on a certain cogency with the objectives in question, in which behaviour and actions are also reflected. The task of human resource management is to ensure that an organisation is efficient and that its performance is constantly improving (Hughes, 2018).

Effective fulfilment of the basic tasks of human resources management requires a wide palette of different activities that are usually referred to as personnel functions. We also assign communication skills among these. Human resources are key; they are also the starting point because they set all other activities in the organisation in motion, and the whole of its activities is directly dependent on them. Here, the communication of the manager in the context of a team or organisation employees and the communication of the organisation externally towards the recipient of information about the organisation are irreplaceable. During the pandemic, the main responsibility rested with the manager; in our case these were representatives, statutory representatives of municipal governments, as well as leaders of social service providers resulting from community plans.

Communication is the basic connection between people in the management process. Only through communication can people in any organisation work more effectively as a whole. Communication has many forms and levels. We communicate through speech, its verbal composition, dynamics and timbre, gesticulation, body position, facial expressions and look. It is important for a person; without communication it is not possible to build relationships, and without creating working relationships it is not possible to work in a team or lead a team. The term communication comes from the Latin word *communis*, which means common, mutual, shared. Communication thus means the transfer of information from the sender to the recipient using verbal or non-verbal symbols, and the condition of this transfer is the understanding of the transmitted information. This definition is the basis of the communication transfer model (Szarková 2018).

It was this basic parameter of communication that in its own way failed to fulfil the needs of citizens in specific community plans. Given the contemporary situation, procedural actions were not included in the plans, especially when it is not possible to conduct communication, receive and provide information in a natural way. Thus, a gap opened between the needs and requirements in a specific form between residents and the municipal governments, which were based on the needs of the "pandemic" society.

Currently, a request was made to include procedural actions into community plans in case of crisis situations for these communities.

This is the relationship between at least two subjects who know about one another and together subjectively share, experience and react to a certain objective situation. If, therefore, we want

to clarify the reaction of two subjects to a certain objective situation, it is necessary to point to the communication between them, as well as the importance of the transmission of messages and information from one subject to another, in our case the municipality and the citizen. We present such important aspects of communication as such.

Communication is one of the most important elements in a community and in organisation. Its function is to ensure the integration of individual components into a coordinated unit, thus enabling the transformation of social inputs into continuous flows that create social systems. Thanks to this, it is possible to modify behaviour and achieve effective changes, and information can be used purposefully and goals can be achieved. (Joniaková et al., 2016).

A specific type of communication with the external environment is marketing communication, through which a municipal government informs about its products, mediates contact between the provider and recipient of a social service and supports the process of exchange. The aim of a municipality in the field of marketing communication is to encourage potential customers, i.e. citizens, to buy goods or services, in this context to increase the quality and trust of the citizen towards the social services provided by the municipality. Image has immense importance. This is the idea that the organisation conveys about itself to all subjects (Přikrylová 2019).

According to Birkner (2016), the quality of active listening depends on a quality communication channel. This contains two-way communication, because reactions to the speech of the participants in the process are expressed through the channel. The author also assigns non-verbal expressions, such as eye contact and others, into the basic signs of active listening. A result of active listening is interaction, which is also presented by feedback, which expresses the satisfaction of those communicating. The result in summary is effective communication.

The mentioned components are important in community planning, in the context of monitoring the needs of citizens, as well as requirements, and a municipal government should communicate the possibilities and limits that arise from the above mentioned.

2.2 Community design

Community projects, such as activities through which services are provided to citizens, should correspond to their needs and demands in a specific form.

Woleková, Mežianová (2004) point to the engagement of the public, which should be informed about the intentions of the municipal government when creating a community plan. Engagement consists in continuously informing the public, as well as intentions and goals. As mentioned above, communication should be relevant to such an extent that the public's constant access to information is ensured through an adequate strategy. This, however, was not established and secured during the pandemic in such a way that the public had the opportunity to enter into the intentions and goals of the community plans. At that time, the provision of social services took on the dimension of a strategy for ensuring the needs of health protection. The authors states further that all activities that are carried out as part of the preparation of the community plan must be interconnected.

Kopcová et al. (2020) formulated specific attributes that emerge from the specific form of preparation and implementation of community plans, and they monitored a period of several years. They point to clearly defined parameters that need to be modified or changed. These are:

- a) financing principles, with a focus on individualisation,
- b) unification of assessment activities, and this involves a more significant differentiation of needs,

- c) amendment of relevant legislation,
- d) equality of social service providers,
- e) orientation on the provision of outpatient services, in a field form, the accessibility of timely intervention,
- f) expanding the provision of social services in the natural environment,
- g) deinstitutionalisation of social services as a primary direction,
- h) specialised programmes when solving social problems of individuals, groups and communities,
- i) financing and remuneration of professionals and experts in the provision of social services,
- j) accessibility of social service facilities,
- k) the provision of crisis intervention,
- l) rehabilitation of a family,
- m) employment of citizens with severe disabilities,
- n) carrying out measures in the area of domestic violence,
- o) protection of victims of domestic violence,
- p) cooperation of a multisectoral and civic nature, in the sense of coordination of the public and non-governmental sectors.

The attributes presented lead us to the preparation and implementation of community plans, in the form of projects that would correspond to the needs of citizens and be presented in a specific form of services, and it is necessary to perceive generational diversity, but also cultural diversity, with regard to citizens of the municipality self-government. In this case, it is not possible to ignore the emerging and ongoing social problems of individuals, groups and communities, especially in a pandemic situation. Communication between providers and citizens, as well as within the system of the organisation that provides social services, must be set in a clear strategy, even in the event of unexpected and crisis situations. We mean clarity and obviousness of communication between the municipality, its residents and the partners of the municipality in the provision and provision of social services.

2.3 Research probe of community plans

We included 3 large municipalities in the research probe, whose community plans are available on Internet portals. The size of a municipality, in terms of the number of inhabitants, is an authoritative statistical parameter, due to a better grasp of the social service offer, as well as the needs of the inhabitants of the municipality. A generational diversity appears here, as does public participation in drawing up community plans.

The aim of the study is to find out to what extent municipalities perceive the needs and demands of citizens in the preparation of community plans, and we are interested in specifying social services and target groups, without using demographic data. We will find out whether municipal governments map the needs and demands of citizens, or whether a reflection of demands and needs can be seen.

The municipality of Slanec is a medium-sized village in the Košice region. The number of inhabitants here 1505; the village has cultural monuments; it is a centre point of the village and has various services available for its citizens. We drew on available sources, the community plan of the village. Currently, the municipality is submitting a project to establish a community centre for the marginalised Roma community.

The tables below present the social services available in the municipality and the needs and demands of citizens in the period 2018 – 2023.

Municipality Slanec

Table 2 Social services provided in the village of Slanec

Service name	Target group
Care provider service	persons with severe disabilities, seniors
Supervision of not fully fledged citizens (cooperation with the district court)	persons with mental and psychological disabilities
Function of a special recipient of social benefits	marginalised groups of citizens
Pensioner meetings	seniors
Assistance in crisis situations – finances	without restrictions
Provision of financial support to dependents	without restrictions
Meals for seniors in the school canteen	seniors

Table 3 Social services needs for citizens of Slanec

Service name	Target group
Care service facility	persons with severe disabilities, seniors
Daily care centre	persons with severe disabilities, adverse health conditions, seniors
Food delivery for seniors	seniors
Field care-provider service	persons with severe disabilities, seniors
Community centre for seniors	seniors
Caring for children up to three years old	families with children
Youth community centre	children and youth

From the data in the tables, we can state that Slanec has basic social services included in the community plan, and the needs and demands of citizens exceed the offer. Of interest is the fact that the offer of social services does not include services aimed at families with children, children and youth, the unemployed and other citizens who are in an unfavourable social situation for other reasons, such as disability, unfavourable health status and retirement age.

From the above, we can state that the municipality does not meet the requirements and needs of the residents in regard to the offer of social services, and for that reason it is not possible to set up a communication strategy, especially in crisis situations.

Municipality Valaliky

Table 4 Social services provided in the village of Valaliky

Service name	Target group
Supervision of not fully fledged citizens (cooperation with the district court)	persons with mental and intellectual disabilities
Function of a special recipient of social benefits	marginalised groups of citizens
Visits to senior citizens marking a jubilee	seniors
Pensioner meetings	seniors
Assistance in crisis situations – finances	without restrictions
Provision of financial support to dependents	without restrictions
If necessary – provision of meals for dependents	seniors
If necessary – provision of a care-provider service	persons with severe disabilities, seniors

Table 5 Social services needs for citizens of Valaliky

Service name	Target group
Provision of social services for resolving an unfavourable social situation due to severe disability,	persons with severe disabilities
Social services due to reaching retirement age	seniors
Social services due to an unfavourable health conditions	persons with an unfavourable health condition
Field social services	without restrictions
Expansion of residential construction	without restrictions
Support for repairs of existing dwellings	without restrictions
Resolving of the barrier-free situation in the village	persons with physical disabilities
Ensuring the provision of social services in a facility	dependent persons
Develop and approve missing local legislation in the area of social services	-
Ensure the possibility of meals for dependents	dependent persons
Provision of care-provider services	dependent persons
Support for the creation of social facilities for the needs of the municipality and the region	dependent persons
If needed, ensure the provision of social services necessary for the municipality	dependent persons
If necessary, provide an assistant for improving the quality of the teaching process for children with disabilities	children and youth
If necessary, the provision of a subsidy to support the education regarding dining habits of a child at risk of social exclusion	children and youth
Provision of mobile social service in a daily care centre	dependent persons
If necessary, social crisis intervention services	without restrictions

The municipality of Valaliky has 4,468 inhabitants; thus, it is classified as a large village. It, too, is based in the Košice region. It has available to its residents a wide range of services; thus, a wide range of social services is also expected. The great diversity of the citizens' age structure and extensive situations that affect them are also assumed, and we also have in mind the diversity of social problems.

As is evident from the tables above, the municipality makes available only basic social services, and the demands and needs of the citizens go beyond the scope of the offer. This means that Table 4 presents the social services actually provided by the municipality, which are also included in the community plan of the given municipality. Table 5 presents the needs of the citizens, which were formulated for the municipality by the citizens themselves, and it included them in the analysis of citizens' needs in its community plan. Therefore, if we compare the social services currently provided by the municipality and the needs of the citizens, we can conclude that the needs of the citizens exceed the available offer of social services from the municipality.

Municipality Kysak

Table 6 Social services provided in Kysak

Service name	Target group
Health care	without restrictions
Housing, accommodation facilities	without restrictions
Education	children and youth
Sports and recreation	without restrictions
Tourism	without restrictions
Cultural facilities	without restrictions

Table 7 Social services needs for citizens of Kysak

Service name	Target group
Social services home	persons with severe disabilities
Reconstruction of the health centre into a social services home	persons with severe disabilities
Daily care providing centre	persons with an unfavourable health condition
Expansion of the daily care providing centre	persons with an unfavourable health condition, seniors
Food delivery	persons with an unfavourable health condition, seniors
Modification of premises for food delivery, replenishment of lunch boxes	persons with an unfavourable health condition, seniors
Access for the immobile	persons with physical disabilities
Installation of a ramp at the municipal office and health care centre	persons with physical disabilities
Care-provider service	dependent persons
Support of field care-providing service	dependent persons

Kysak is also located in the Košice region. The population of the village is 1361, putting it into the category of medium-sized villages. It has a railway junction and several attractive hiking trails. Regarding the provision of social services by the municipality, we present the data in tables. A point of interest is that there are no specific social services available in the community plan, but only areas that are considered part of the social area.

The above tables show that the community plan of this municipality differs from the previous ones, mainly in the presentation of current social services. This community plan does not include any specific social services. The setting of the development of social services is anchored in the plan as a vision (years 2017 – 2021), which is in the end the need and demand of citizens. The plan presents specific projects with a time frame for implementing them.

Upon comparing the submitted community plans, we can state that the municipalities of Slanec and Valaliky provide their citizens with identical across the board social services. Kysak does not provide any specific social services. The first two municipalities map the needs and demands of their citizens and specifies them in the community plan. The third municipality, working through community projects, is currently going through the stage of creating opportunities for citizens who lack access to basic social services.

We strategically selected these villages due to their proximity to the regional capital, whereby they have a nodality character. Community plans are documents whose register is kept by a higher territorial unit.

However, we point to a certain across the board nature of the social services provided, while we hold the topic of the

individuality of services for citizens; thus, there is a diversity of types, forms and types of social services. This is absent in community plans, however.

2.4 Results and discussion

During the statistical processing of indicators from the community plans of individual municipalities, we used the study of documents, analysis and comparison, where the variable was specific social services.

Slovakia's Act No. 448/2008 on Social Services offers the municipality, as a provider of social services, several specific and precisely targeted social services, as regards a social problem or an unfavourable social situation. Every single service can be provided or at least ensured by the municipality to its residents through a non-public provider.

We determined the quantitative and percentage number of options, that is, specific social services, emerging and clearly defined in the Social Services Act. We further determined the quantitative and percentage number of specific social services that each of the selected municipalities currently provides and compared these two parameters. Subsequently, we determined the quantitative and percentage number of specific social services, based on the needs of citizens, which is included in the community plans of selected municipalities as a needs analysis. We thereby worked with three parameters: social services by law, social services actually provided by the municipality and the needs of citizens in specific social services. We compared the three mentioned parameters in the graphs below, in each selected village.

Municipality Slanec

Table 8 Two parameters of the municipality Slanec

social services and facilities	100%	36
provided by the municipality	19%	7
others	81%	29

Municipality Valaliky

Table 9 Two parameters of the municipality Valaliky

social services and facilities	100%	36
provided by the municipality	22%	8
others	78%	28

Municipality Kysak

Table 10 Two parameters of the municipality Kysak

social services and facilities	100%	36
provided by the municipality	0%	0
others	100%	36

Chart 2 Provision of social services by municipalities and a comparison

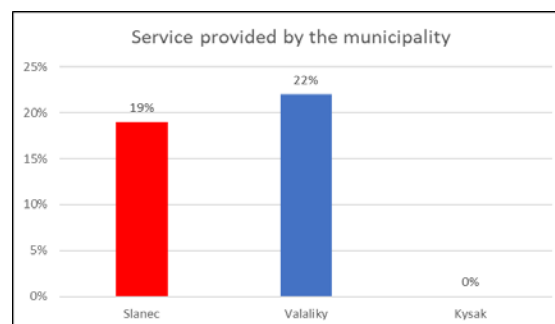


Chart 2 shows that Slanec provides social services for residents in only 19% of the 36 (100%) possibilities that follow from the law. Valaliky provides social services for residents in only 22% of the possibilities that follow from the law, while Kysak does

not provide social services for residents in a specific form. Only areas that we can summarise into community services are included in the community plan. Social services resulting from the law were not specifically presented in the community plan. In other words, we state that 0% of the social services provided by the municipality are from the possibilities enshrined in the law.

As part of the comparison, we note that out of the selected municipalities, Valaliky provides the most social services for its citizens, while specific possibilities, that is, services and facilities are presented by the Act on Social Services in the number of 36 (100%).

Municipality Slanec

Table 11 Three parameters of the municipality Slanec

social services and facilities	100%	36
provided by the municipality	19%	7
needs of citizens	19%	7
others	61%	22

Municipality Valaliky

Table 12 Three parameters of the municipality Valaliky

social services and facilities	100%	36
provided by the municipality	22%	8
needs of citizens	47%	17
others	31%	11

Municipality Kysak

Table 13 Three parameters of the municipality Kysak

social services and facilities	100%	36
provided by the municipality	0%	0
needs of citizens	28%	10
others	72%	26

Chart 3 Provision of social services by municipalities, analysis of citizens' needs and a comparison

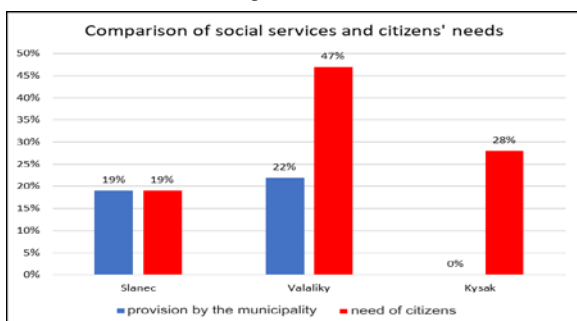


Chart 3 shows that Slanec provides 19% of all the options included in the law, while the other 19% comprises citizens' needs. The real social services provided by the municipality and the needs of citizens are not identical to specific social services. Valaliky provides 22% of the total options included in the law, while the other 47% is the citizens' need. The true social services provided by the municipality and the needs of the citizens are not identical. Kysak does not provide any specific social services out of the total options included in the law, while 28% is the need of the citizen. Here we note that the municipality perceives the real needs of the citizens, since they are included in the analysis of the needs of the community plan; the municipality also plans to provide real social services based on the citizen need, but at present the state of providing social services by the municipality towards the citizen is not satisfactory.

In the opposite view, Slanec does not provide or ensure and it does not even include in the analysis of citizens' needs up to 61% of the social services anchored in the law. Valaliky does not

have 31% of the social services declared by the legal guidelines included in the social services provided and in the needs of citizens. In the case of Kysak, up to 72% of the social services anchored in the law are lacking in the provided social services and the analysis of citizens' needs.

Comparing the municipalities, we could assess that the most ideal situation is found in Valaliky, which provides social services to citizens, maps their needs and includes them in the community plan. Although Slanec provides social services, it also perceives the needs of citizens, as they are included in the community plan, but we consider the given state to be insufficient in terms of the quality and availability of social services for the citizen. Kysak does not present the currently provided social services in the community plan, which we consider insufficient, because the needs of citizens are included in it. The community plan of this municipality does not even refer to another provider of any of the social services that the citizens are interested in based on their needs. However, the plan does contain specific dates aimed at the implementation of social services towards citizens. The tendencies of the given community plan are set out such that the municipality will provide at least a few social services in the future.

It is important to note that not a single community plan featured social services or defined strategies in the event of a crisis situation.

3 Conclusion

Community plans are an important document, which should take a real form in the development of municipal self-government, mainly in the direction of satisfying the needs and demands of citizens. On the other hand, they should reflect the demands of society as well as the social policy applied in public administration.

The development of a municipality and the optimisation of the life of its citizens take place on their basis. Municipal self-government as a territorial administrative unit should aim for closer accessibility to the citizen. The implementation of these attributes should be done through the requirement of communication and receiving information both from the citizens towards the municipality and from the municipality towards the citizen.

By analysing the selected community plans, we can state that their specification has certain deficiencies. Their preparation reflects legislative amendments, but the needs and demands of citizens are more specifically and clearly formulated with a focus on target groups. Each target group expects the fulfilment of their needs due to an unfavourable social situation.

Here a certain dilemma occurs in the context of the preparation and implementation of community plans.

We believe that community plans should be set in a specific form for the citizen – client – recipient of social services, so that in each case it is possible to include all residents into the system, due to unexpected social problems and situations, such as the COVID-19 pandemic. We believe that community plans should be set in a specific form for the citizen – client – recipient of social services, so that in each case it is possible to include all residents into the system, due to unexpected social problems and situations, such as the COVID-19 pandemic.

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Primary Paper Section: A

Secondary Paper Section: AD

THE ADVANTAGES AND DISADVANTAGES OF DISTANCE TEACHING AND LEARNING FROM THE PERSPECTIVE OF SECONDARY SCHOOL PUPILS

^aPETER MARINIČ, ^bJAN PĚKNÝ

Masaryk University, Faculty of Education,
Department of Physics, Chemistry and Vocational Education,
Poříčí 7, 603 00 Brno, Czech Republic
email: ^amarinic@ped.muni.cz, ^b515618@mail.muni.cz

Abstract: As time goes on, the number of studies on evaluation of teaching and learning during teaching restrictions has been increasing. However, identifying the benefits and risks of distance education is important, as teaching activities may be restricted in the future or hybrid form of teaching can be used in the future. Therefore, we present results of a survey among 162 secondary school pupils conducted in March 2022, which indicates that the respondents would choose a hybrid form of education, even though they evaluate distance education rather negatively, see it as a reason for tutoring, and prefer classical form of teaching to distance education. The results are compared with the results of other studies. The influence of connectivism and the increasing number of pupils referred to as digital natives is also recognized.

Keywords: distance education, online teaching, teaching methods, teaching evaluation, quality of teaching, blended learning, connectivism.

1 Introduction

The situation that occurred in 2020 in connection with the spread of the COVID-19 disease affected the society in a wide range of activities. Today, with the passage of time, the assessment of the given situation may appear diversely. The measures taken in connection with this disease had a significant impact not only on our society, but in almost all areas of our lives.

In the field of education, classic in-school teaching has been limited, almost overnight. All actors in education were affected by these measures and had to look for ways to provide teaching under the given, rapidly changing conditions. For pupils in primary and secondary schools, this meant a move from the school environment to home conditions, thus the change in education from contact in-school teaching to teaching and learning conditions carried out through a wide range of tools enabling distance teaching and learning. It was not an easy situation for teachers as well. Teachers also had to find ways to ensure a sufficient level of teaching in these conditions of teaching restrictions (Rokos & Vančura, 2020; Brom et al., 2020; Švaříček et al., 2020; Adamec & Šimáně, 2021; Šalamounová, 2022).

In the period of the second half of the 2019/2020 school year, ways and possibilities were therefore sought almost immediately to ensure education could continue even under the mentioned conditions. For the following school year, 2020/2021, at least the summer vacation months were already available for preparation of educational process. Teachers could use to prepare distance teaching and learning, especially using digital technologies, and other means of distance education. The next school year ended up taking place in the conditions of limited in-school educational process. However, teachers could already use the experience gained from the previous months and holiday preparations (Pavlas et al. 2020; Pavlas et al., 2021).

Although it may currently appear that we are not in danger of further restrictions on educational process in the form of classic in-school teaching conditions, the experience of implementing teaching and learning under conditions of limited in-school educational process after March 2020 can provide valuable information for future application. The information about restricted in-school educational process could provide useful knowledge, not only in the case of future restrictions due to any reason, but also in connection with the rising trend of using digital technologies in educational process, changing the approach of teachers and pupils to the digital technologies and their use in a wide range of life situations including teaching and learning activities, and also applying the concepts of connectivism in the educational process (Svoboda et al., 2020).

Therefore, in our survey, we focused on examining the issue of evaluating experiences from the period of educational process restrictions at a selected secondary vocational school with an economic focus in Czech Republic through the pupil's perspective.

The main goal of our survey was therefore to obtain information about the view and assessment of the pupils at this chosen school on the educational process during the period of its restrictions, with the intention of obtaining an answer to the established research question: *How do the pupils at the selected secondary schools evaluate distance education in comparison to classical in-school education?*

The main research question can be elaborated to the following questions:

1. How do the pupils at the selected secondary school evaluate their own readiness for distance educational process, especially regarding their material background?
2. How do the pupils at the selected secondary school evaluate the educational process during the distance form of teaching in terms of the organization of the educational process and the chosen teaching methods?
3. Which benefits and failures do the pupils at the selected secondary school identified in connection with distance teaching and learning?
4. How do the pupils at the selected secondary school approach the possibility of distance education, or hybrid form of education, in the future?

These sub-research questions are subsequently used to organize the obtained information during the presentation of the obtained survey results and are further elaborated in more detail.

2 Previous research on the effects of teaching restrictions

Several research were already carried out in 2020 in connection with the limitation of teaching and learning due to the measures introduced to prevent the spread of the pandemic. In the following period, the issues of distance education in its various forms became an increasingly researched area, and researchers from different countries contributed their knowledge and collected data to clarify the impact on education in this context.

From the initial research carried out already within a few weeks after the restrictions on teaching were introduced, we can cite the findings of the PAQ agency, which mapped the economic situation and the effects on the education of pupils of different age categories and at different levels of the educational system. The survey covered pupils of primary and secondary schools, on a sample of approximately 500 respondents, by collecting data from the parents of these pupils (Prokop et al., 2020). This research pointed to the fact that parents had to take care of their children, who remained at home due to the pandemic measures, and to a large extent also to ensure their education. They devoted an average of 2.5 hours to activities connected with distance teaching and learning of their children. Parents without high school diplomas devoted themselves to their children's educational activities to an even greater extent, and at the same time, those parents expressed much less satisfaction with the school's activities carried out by teachers and other school representatives during this period.

Brom et al. (2020) also approached the issue through quantitative research. In this research, authors investigated the time-consuming nature of educating pupils of different ages and at different levels of the educational system, as well as broken down according to parents' educational attainment and families' socio-economic status. In the study conducted on a sample of 9000 respondents by Švaříček et al. (2020), researchers used the qualitative approach to the topic. Although the sample could not be considered representative, researchers point out to the already

mentioned tendencies and considerable time requirements of distance teaching and learning in that time.

The situation at primary and secondary schools has also been repeatedly mapped by the Czech School Inspectorate, which already in the second half of the school year 2019/2020 was investigating the situation at schools by telephone interviewing of 5,000 principals (Pavlas et al., 2020). The interviewing was aimed directly at managing the situation with the efforts to provide teaching activities by teachers in connection with teaching restrictions because of government measures. In the re-investigation of the effects of the teaching restrictions of the classical in-school form of teaching, information was already ascertained in connection with the pupils' situation from the point of view of the situation in the family, readiness for teaching and learning process, time requirement and burdens of this educational process and other aspects of distance teaching and learning (Pavlas et al., 2021).

Rokos and Vančura (2020) conducted a survey among teachers, pupils, and their parents at a selected school at the beginning of teaching restrictions. Their findings correspond with the above-mentioned findings regarding the time-consuming nature of distance teaching and learning or the need to involve parents in the educational process. Contrary to the findings of the Czech School Inspectorate, however, they do not identify the technical requirements for educational process as a problem, as the school has proceeded to help pupils in this area. However, the authors consider the methodological preparation of teachers to be the most important in case of the inevitable implementation of distance learning in the future.

A study by Šalamounová (2022) provides an interesting perspective on the issue of the organization of distance education. In his study, she deals with the issue of distance education from the point of view of the autonomy of teachers in the organization of teaching and the support of school management in the areas of technical and technological backup of distance learning. If the school management took responsibility for the technical, organizational, and conceptual backup of teaching, it enabled teachers to focus on the development of the digital competences of individual teachers and the didactic aspects of teaching specific subjects. In the case of individual teachers' autonomous approaches to distance education, there was a development of these competencies among a certain group of teachers, but not comprehensively within the entire school.

3 Methodology

Although, there are already several investigations of the effects of educational process restrictions, we nevertheless consider it appropriate to return to this issue and continue to monitor the situation, as the view and retrospective evaluation of direct participants changes over time. Therefore, a questionnaire survey was conducted on a sample of 162 respondents, who were pupils at a selected secondary school with an economic focus on the Business Academy. Data collection took place in March 2022 in the form of an electronically completed questionnaire combining closed and open questions. Closed-ended questions were evaluated with descriptive statistics, and open-ended questions were evaluated by grouping meaningfully similar responses.

It is therefore an available selection, where the limit is the possibility of generalizing the information obtained. Despite this limitation, we consider the obtained data and the possibility of their comparison with the already presented results of the conducted research to be an important part of the discussion about the potential and limits of the distance form of teaching in the future or possibilities of hybrid form of teaching and blended learning.

The survey was conducted with the participation of teachers who administered the questionnaires to the respondents, which resulted in a participation of 162 respondents. The survey was conducted among second-, third- and fourth-year pupils, as

information was sought regarding the course of teaching at the secondary school affected by the restrictions on teaching, which was not met for first-year pupils. The distribution between the individual pupils' groups according to given year of education was even (1st year 32%; 2nd year 36%; 3rd year 32%) and the representation of male (38) and female (124) corresponds to the interest and standard distribution for the field of education in which female dominates.

The collection of data and their processing were also part of the diploma thesis of the second author, while the first author was the supervisor of the thesis.

4 Results of a survey among pupils

Our survey focused on evaluation of the teaching and learning in the form of distance education from the perspective of the pupils themselves was therefore focused on areas that were related and were identified as important areas in connection with the distance form of education in the period of restrictions on the classical school form of education.

We have therefore included these areas:

1. pupils' readiness for teaching, especially about their material background,
2. the teaching process according to the chosen organizational forms and methods of teaching,
3. assessment of benefits and failures in connection with distance teaching and learning,
4. the possibility of maintaining distance education in the future.

The individual data obtained are therefore presented in this arrangement. The presentation of results provides an overview of absolute and relative frequency. Interrelation and deeper connections can also be identified with some data and can therefore be used for a more comprehensive clarification of the researched areas. In the contribution, however, we limit ourselves only to a verbal description of the outlined links.

4.1 Pupils' readiness for teaching and learning

Due to rapid introduction of distance education in the Czech Republic without enough time to react, the area of pupils' readiness for teaching and learning is very important. In addition, the situation was complicated by the fact that, at the same time as the restriction of classical schooling has been introduced, other measures that limited the movement and mutual meetings of people, such as the introduction of working from home where possible, the closure of shops and providers of various services were also introduced. This created a situation where not only pupils stayed in the households due to teaching restrictions in the form of distance education, but also parents often worked. This increased the demands on the equipment of the households with technologies enabling remote access and communication. The first area of the survey was to find out whether the pupils were sufficiently equipped for distance teaching and learning, or whether they did not incur additional extraordinary financial expenses in connection with distance education.

Tab. 1: Pupils' readiness for distance education and the extraordinary costs of distance education

	Pupils' readiness for distance education	The extraordinary costs of distance education
yes	26.5%	14.8%
more likely yes	54.3%	14.2%
more likely not	15.4%	25.3%
no	3.7%	45.7%

Source: Authors' own work according to collected data

As can be seen from the obtained data, at least in the case of our respondents, the vast majority (80.9%) were sufficiently materially prepared for distance education, both in terms of the

technology needed for the implementation of distance education, and in terms of home facilities and a stable internet connection. The situation in this case is perhaps improved by the fact that the respondents are pupils in secondary vocational education who are already normally equipped with technology sufficient for remote access and communication, can work with it in an adequate way and have suitable conditions created in their home environment. For this reason, too, they did not have to face, and in many cases (71.0%), according to the statements of the respondents, there was no increased financial burden to manage the situation (see Table 1). Respondents mostly used smartphones (42.9%), laptops (41.6%), personal computers (13.7%) and only exceptionally tablets (1.9%) for distance education.

4.2 Teaching process

In the survey, we also focused on questions aimed at clarifying the forms and methods of distance teaching and learning that were used in their case. Since teachers had to react quickly to the situation, especially in the period immediately following the limitation of the classical school form of teaching, in many cases they were not able to choose an adequate form of compensation for distance education. The following months of the summer holidays then provided space for improving the situation in this area in the next school year 2020/2021. However, there were still teachers and schools in which the situation did not significantly improve (Pavlas et al., 2021).

That's why we were interested in:

- how the teachers provided the new material in teaching process,
- whether interactive applications were also used for distance teaching and learning,
- how the distance form of teaching was demanding in terms of time for the pupils.

In the first step, we focused on the method of transmitting information from the teacher to the pupils, i.e., on the method of mediating the new subject matter by the teacher. The obtained results according to the pupils' answers are shown in Table 2. The obtained data show that the presentations were mostly prepared by the teacher (29.8% of the answers) and then shared through the used platform for the implementation of distance teaching and learning. In addition, this method allows easy sharing of information with pupils by sharing created materials. The second most frequently method used (26.8% of responses) was pure transfer through the selected platform. Videos (15.6%), scanned texts (14.3%) or own materials created by the teacher (12.9%) were used less often.

Tab. 2: Method of teaching new material by the teacher

	Absolute frequency	Relative frequency
presentation	157	29.8%
pure transmission	141	26.8%
video	82	15.6%
scanned texts	75	14.3%
own materials	68	12.9%
other method	3	0.6%
experiments	0	0.0%
total	526	100.0%

Source: Authors' own work according to collected data

Given that pure transmission was used quite often, it is quite surprising to find that teachers did not require pupils to turn on the webcam in 96.9% of the cases according to the respondents' answers (specifically, the respondents answered "no" in 37.7% of the cases and "more likely not" in 59.3% of cases). Even more surprising is that the teachers did not have a webcam running either (13.0% of the respondents answered "no" and 46.9% of the respondents answered "more likely not" when asked if the teacher had a webcam running during the lesson). On the other hand, the answer to the reasons for turning off the webcam, both, on the part of the pupils, but especially on the part of the teacher,

can be identified through the answers to the question of the frequency of problems in communication caused by a low-quality Internet connection or a failure of this connection. Respondents always or often faced the mentioned problem of data transfer quality in 29.1%, and at least occasionally the given problem occurred in 56.8% of other cases. Problems with data transfer quality were reported rarely by 14.1% of respondents and no (0.0%) respondent reported that data transfer quality issue ever occurred. Since image transmission significantly increases the requirements for a network connection, its non-use can be considered a legitimate way of maintaining at least an audio connection when securing distance education.

Even though pupils and teachers faced technical difficulties in the implementation of distance learning, respondents rated the communication with the teacher as understandable (in 8.6% of cases the answer was "yes" and in 75.9% of cases "more likely yes"). Pupils also confirmed sufficient space for asking questions during distance learning (34.0% of respondents answered "yes" and 58.6% "more likely yes" to the question of whether sufficient space for questions was provided by the teacher).

Another area that interested us about teaching process was the use of interactive applications during the distance education. Distance form of teaching and learning directly encourages the use of interactive applications, as pupils are already forced to use computers for learning purposes, and therefore there is room to use computers also to include interactive applications in teaching process itself. Although, according to the respondents' answers, teachers used interactive applications in teaching process (74.7% of the respondents said that the teachers used or rather used the applications), the frequency of their use was relatively small (70.2% of the respondents indicated the use only "sometimes" and 22.3% of the respondents indicated the use only in "rarely" cases). The dominant position among the interactive applications used has Kahoot! (74.8% of respondents chose the option), followed by Quizlet (11.9% of respondents) and Forms (4.2% of respondents).

Considering the distance form of teaching and the associated modified approach to the implementation of teaching during distance education, potential technical problems with the quality of data transmission and other factors, it would be possible to expect that the time requirements of distance education will increase. Table 3 provides an overview of this issue.

Tab. 3: Time requirements of distance education

	Did you spend more time learning in distance education than usual?	Did you have enough time for tasks?
yes	42.6%	8.0%
more likely yes	29.0%	42.0%
more likely not	24.1%	42.0%
no	4.3%	8.0%

Source: Authors' own work according to collected data

From the time requirements point of view, respondents stated in their answers that distance teaching and learning caused an increased time requirement for them. Specifically, they expressed that they had to devote more time to studying than usual (42.6% of respondents answered "yes" to the given question and 29.0% answered "more likely yes"). At the same time, half of the pupils stated that they had enough time for tasks related to the implemented distance teaching and learning.

4.3 Evaluation of the teaching process

As it follows from the results presented so far, distance education in the case of the respondents of our survey took place to a large extent without significant complications, even though the respondents experienced increased time requirements. Based on the data presented, it can therefore be concluded that distance education had certain positives, but also certain negatives, from

the point of view of the respondents. We therefore explicitly focused on this area as well.

That's why we were interested in:

- how pupils evaluate the quality of teaching in connection with distance education,
- what positives do the pupils perceive in connection with the implemented distance education,
- what negative aspects do pupils perceive in connection with distance learning.

The quality of teaching is also evaluated in classical in school teaching. There are many possible approaches for this evaluation, based on the evaluation of many criteria and measurable parameters. However, for the evaluation of the quality of distance education, we decided to apply the approach of subjective evaluation of the quality of distance education from the perspective of the pupils, i.e., the respondents in our survey.

Tab. 4: Time requirements of distance education

	Do you feel that you have learned more (or at least the same) information in distance education than in classical education?	Did you need tutoring during distance education?	Was the distance education the reason for tutoring?
yes	1.2%	27.8%	28.9%
more likely yes	8.0%	-	40.0%
I don't know	13.0%	-	11.1%
more likely not	38.9%	-	11.1%
no	38.9%	72.2%	8.9%

Source: Authors' own work according to collected data

As can be seen from the results shown in Table 4, the respondents express themselves rather negatively in relation to the quality of distance education. Specifically, 38.9% of respondents feel that they did not learn the same amount of material in distance education as in traditional school education (38.9% answered "no" to the first question). Also, the same percentage of respondents are more inclined towards this option (38.9% of respondents answered "more likely not"). Only a small part of the respondents (9.2%) finds distance education more beneficial in terms of learning the educational content.

Despite this negative assessment of the quality of distance education and the impact on educational outcomes, only 27.8% of respondents needed tutoring during distance education, which 68.9% of respondents identified as related to ongoing distance education. These results thus indicate a potential resignation to the identified worsened situation because of distance education, which would require increased learning activity in the form of tutoring. This resignation could be related to the broader conditions in which distance education took place, i.e., the impossibility of social contacts, the need to implement tutoring also in a distance form, which was the original reason for tutoring, as well as the workload of the pupils and the lack of time to implement the tutoring itself.

According to the results of the survey, during the period of distance education, the socialization element provided by the school environment was the most missing for the pupils. Specifically, 40.2% of respondents stated that they miss direct contact with classmates. The absence of this direct contact with classmates has a negative impact on the socialization aspect that school education brings, but it can also be seen as a potential cause of a worse assessment of the quality of distance education and pupils' non-use of tutoring. Similarly, 22.8% of respondents

indicated that they missed direct contact with the teacher the most. The absence of direct contact with the teacher can also negatively affect the evaluation of the quality of distance education and is also related to the possibility of implementing the necessary tutoring to achieve better learning outcomes.

Among the other areas mentioned, which the respondents lacked during the distance education, is motivation and concentration. This aspect was mentioned by 17.9% of respondents. Especially in the case of the organization of distance education daily respecting the classical timetable, the distance form of teaching and learning becomes very burdensome with a negative impact on concentration and possible additional motivation to learn. It is also related to the lack of school and classroom environment (mentioned by 8.9% of respondents), leading to the absence of social contacts and the positive influence of the school and classroom climate.

However, no matter how the respondents evaluated distance education so far, they were able to identify the positive aspects of this form of education. An overview of the positive aspects of distance teaching and learning is clearly shown in Table 5.

Tab. 5: Positive aspects of distance teaching and learning

	Absolute frequency	Relative frequency
more time for tasks / own interests	55	25.1%
waking up later / sleeping longer	38	17.4%
home environment	34	15.5%
not having to commute to school	30	13.7%
regular breakfast	12	5.5%
no positives	50	22.8%
total	219	100.0%

Source: Authors' own work according to collected data

Even though most respondents stated that they did not identify any positive aspects of distance education (22.8% of respondents' answers), aspects associated with the fact that distance education takes place in the comfort of their homes dominated among other respondents. The most mentioned positive aspect was more time for tasks and personal interests (25.1%), which will be related to another positive aspect, namely the fact that pupils do not have to commute to school (13.7%), which gives them more time. It was also marked as a positive aspect that they do not have to get up early, or they can sleep longer (17.4%), because of reducing the time needed to commute to school. The home environment (15.5%) was also perceived as positive aspect and, in combination with the above-mentioned aspects, contributes to better eating habits of pupils, as a regular breakfast (5.5%) was also marked as positive aspect.

Tab. 6: Negative aspects of distance teaching and learning

	Absolute frequency	Relative frequency
too many tasks	44	19.3%
problems in communication	38	16.7%
misunderstanding of the education content	36	15.8%
disproportionate length of lessons	27	11.8%
short time for knowledge verification through tests	25	11.0%
limited amount of movement	11	4.8%
no positives	47	20.6%
total	228	100%

Source: Authors' own work according to collected data

Of course, distance education also has its negatives from the point of view of our survey respondents. Table 6 provides an overview of the stated negative aspects. The stated aspects are related to some of the already stated views on distance education. As in the previous case, also with the negative aspects approximately one fifth of the respondents' answers refer to the fact that they do not find any negative aspects of distance education (20.6%). More significant negatives relate to the organization of teaching, such as too many tasks (19.3%), short

time for knowledge verification through tests (11.0%), and disproportionate length of lessons (11.8%). Identified negatives are also related to the educational content, specifically misunderstanding of the education content (15.8%), which could also be caused by problems in communication (16.7%) or other technical complications mentioned above. The very character of distance education, which uses communication technologies to mediate teaching and learning process, forces pupils to spend a lot of time at computers or other means of communication. This is the reason for the perceived negative aspects in the form of a limited amount of movement, or the need to sit for a long time at the computer (4.8%).

4.4 Possibility of distance learning in the future

Our survey aimed at distance education pointed to the possibilities of the use of distance teaching and learning in the future, even though it simultaneously pointed to the limits of its widespread and especially long-term introduction. Respondents identified both positive and negative aspects in relation to distance education. However, it can be assumed that some form of distance teaching and learning, or blended learning, will be reintroduced in the future, although it is not possible to identify the reasons that will lead to its introduction, and thus its specific form in the future. It could be the widespread introduction of distance learning due to the societal need to protect the health of the population, for economic reasons, or just a certain form of innovation in education in connection with the necessity of using new technologies in the economy and therefore also in education, or an effort to increase the effectiveness of the educational process. Therefore, we selected two options for respondents to assess. The first option was a choice between classic school teaching and distance education. The second option was a hybrid arrangement, where classical school teaching would be implemented to a predominant extent, i.e., four days a week, and distance education in the remaining time, i.e., one day a week. We were interested in which of the listed options would the respondents prefer in the future.

If the respondents had a choice between a classical form of school education and a distance form of education, the majority (54.9%) would choose classical in-school education. Only 21.0% of respondents would be in favor of full distance education, and for the other respondents (24.1%) the organization of education is irrelevant. It can therefore be assumed that the negatives and complications associated with distance learning are perceived by pupils as significant, and the advantages resulting from the realization of teaching at school, probably especially in the field of socialization, lead them to choose classic school teaching. It is interesting, however, that if the respondents were given the option of choosing between classical school teaching and a hybrid form of teaching, organized for example in the above-mentioned way, the majority (58.0%) would lean towards the hybrid form of teaching, 32.1% would then prefer the classical form of in-school teaching, and only 9.9% do not consider the organization of teaching into these two options to be relevant.

It can therefore be assumed that organizing teaching in a hybrid form would include the positive effects of both methods of organization of teaching and learning process. That is, the pupils would have sufficient space to maintain personal contacts with each other and with the teachers, the socialization aspect of the educational process would be fulfilled, but the hybrid form of teaching would also provide at least partially the opportunity to realize the benefits felt by the pupils, especially in areas of limiting the need to commute to school, gain more time for their extracurricular and leisure development. Thus, the hybrid form of teaching appears to be an optimal option for use in the future. Especially in areas of education that make greater use of new digital technologies and the element of connectivism in the educational process.

5 Discussion of survey results

Research in the area of impact of the pandemic on education has become an important part of research and publication activity

since 2020. In the period of a few years, the volume of published conclusions that examine the issue of the impact of the pandemic on education from many perspectives has increased significantly (Cretu et al., 2023).

In this sense, by presenting and interpreting the results of our survey, we are trying to contribute to a better understanding of the impact of teaching restrictions and distance education, from the point of view of pupils. We also stress the potential of using distance education in the future, either in its full scope or as a mixed hybrid form of education that would combine the advantages of distance education and traditional in-school education.

As our survey shows, pupils during the period of teaching restrictions, i.e., during forced distance learning, faced similar problems as those identified in other research (Rokos & Vančura, 2020; Švaříček et al., 2020; Brom et al., 2020), or even in the reports of the Czech School Inspection (Pavlas et al. 2020; Pavlas et al. 2021).

From the point of view of the future application of distance education, it seems important to emphasize the ability of teachers to properly prepare for such education. This preparation is related to the form in which the distance education would be introduced. In the case of widespread implementation, collaboration between school management and individual teachers seems to be significant. There have to be their mutual coordination and cooperation to ensure a comprehensive form of distance learning (Pavlas et al., 2021; Šalamounová, 2022). From the point of view of preparing individual teachers to handle such a transition, it can be assumed that individual teachers will be able to do it, as they have already had enough time to develop their digital competences (Barnová et al. 2022), as well as other necessary competences to ensure distance learning (Pavlas et al. 2021).

As our research shows, tutoring is an important area during distance education. Tutoring and providing consultations by the teacher has the potential to significantly reduce the burden of distance education. However, for an effective tutoring process, teachers need to be able to carry out this activity effectively. The use of consulting services during their studies as future teachers can develop this ability. In this respect, students in teaching educational programs can use the services of counseling centers established by universities (Adamec & Janderková, 2021). Future teachers, but not only them, can gain direct personal experience with tutoring and consulting students in a wide range of areas related to the educational process and transform that experience in their own practice.

6 Conclusion

The results of the survey indicate the readiness of pupils for distance learning in terms of household equipment and background (71.0% of responses). The low use of the webcam by pupils (3.1%) and teachers (39.5%) could be due to connection problems (85.8%). Teachers used mainly own presentations (29.8%) and pure transmission (26.8%) during the distance education. Teachers also used the applications (74.7%), although only occasionally (70.2%) or rarely (22.3%). There was room for questions (92.6%) and communication with the teacher was clear and understandable (84.6%). However, pupils had to spend more time to learn (71.6%), which may be due to lack of time for assigned tasks (50%) during the distance teaching and learning. Pupils evaluate the quality of teaching rather negatively (77.8%). Because of distance education some of the pupils need a tutoring (27.8%) and the most of those pupils (68.9%) identified distance teaching and learning as the reason for tutoring. Although pupils prefer the classic in-school form of teaching (54.9%), due to direct contact with classmates (40.2%) and the teacher (22.8%), they would choose the option of a hybrid form of teaching – blended learning (58.0%).

Our survey indicates that pupils would prefer the possibility of a hybrid form of teaching and learning. We assume that this

hybrid form of education would enable pupils to take advantage of the positive aspects of distance education and at the same time eliminate the perceived negative aspects. A hybrid form of teaching would allow pupils to partially reduce the time-consuming commute to school, create space for extracurricular and leisure activities, but at the same time preserve the positive aspects of contact with classmates and teachers, and adequate exchange of experiences in the school environment. However, for the effective implementation of the hybrid form of teaching and learning, it is important to develop appropriate competences of teachers, to create suitable organizational conditions in schools and to adapt the educational content within the curriculum in an adequate way. It would be possible to include appropriate elements of the curriculum in the distance part of hybrid education, i.e., educational content focused on the use of digital technologies, which are used both in the real world of economic practice and in education. This aspect is very important in connection with the development of vocational education in the future, since today we already see an increase in the use of digital technologies in a wide range of life and work activities. This trend is also related to the introduction of the element of connectivism in education and the increasing application of the blended learning approach in education.

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MULTILATERAL REPRESENTATION OF SHOAH EVENTS IN SELECTED FICTION TEXTS: PRESENTATION OF RESEARCH RESULTS

^aMILAN MAŠÁT, ^bJANA SLADOVÁ

^aPalacký University Olomouc, Faculty of Education, The Department of Czech Language and Literature, Žižkovo náměstí 5, 771 40 Olomouc, Czech Republic

^bPalacký University Olomouc, Faculty of Education, The Department of Czech Language and Literature, Žižkovo náměstí 5, 771 40 Olomouc, Czech Republic
email: ^amilan.masat@upol.cz; ^bjana.sladova@upol.cz

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Abstract: In this paper, we present selected results of a probing research investigation that focused on the degree of reception and interpretation of selected literary texts in which the multilateral view of the Shoah or Holocaust is thematized. The respondents of the research were pupils of all grades of the Czech lower-secondary school. After an introduction in which we present the research methodology and briefly outline the potential of artistic narratives that contain a multilateral view of the defined events, we present the results of the research investigation. A multilateral perspective not only on the phenomenon of the Shoah or the Holocaust can develop students' ability to critically evaluate information and can hone their argumentation skills. Finally, these works prevent a schematic view of defined events, which can lead to the prevention of forming hasty opinions or making unfounded or unreasoned judgments.

Keywords: Shoah, Holocaust, multilateralism, research investigation, Between Shades of Gray, Salt to the Sea.

1 Introduction

In this paper, we present partial results of a research investigation, the focus of which was to determine the degree of reception and interpretation of texts with Shoah or Holocaust themes (for the purposes of this paper, we consider these terms as synonymous; see Carrier et al., 2015) by students who were attending the eighth or ninth grade of basic education the time of the research.

Pupils in the grades reciprocated fictional narratives that combine multilateral representations of defined events. We are convinced that this approach can lead to the elimination of the schematic view of the events in terms of guilty and victimized people, to the detachment from the concept of collective guilt or innocence, or to the view of the events through the prism of different actors (for example, Jews, Germans, Roma, or inhabitants of the Protectorate of Bohemia and Moravia).

We are convinced that the reception of these texts can lead, among other things, to the development of desirable axiological values of pupils, to the acquisition of the ability to argue or to critically assess information, in our case obtained from reading artistic narratives. Finally, we see the approach of reading narratives in which the events of the Holocaust are portrayed multilaterally in developing the recipients' ability to view (not only) these events in a complex way.

2 Research methodology

The questionnaire for students from each grade was specific, with a unique research instrument for each group of respondents. The questionnaire consisted of an excerpt from one publication that dealt with a multilateral view of the Shoah events (the publications chosen were those that, in our opinion, have the potential to interest the pupils and which, in most cases, they have not encountered before - this fact ensures a certain identical starting position of the respondents). This was accompanied by five or six questions which measured the level of understanding of the narrative, the depth of interpretation and, in relation to the topic of the extract, the pupils' existing knowledge of the Second World War. We are aware that pupils currently in compulsory education are not introduced to the historical events associated with the 20th century until ninth grade in the History curriculum (see Faltýn et al., 2021, p. 61); however, we are of the opinion that they are also introduced to some historical stages in other

subjects or cross-cutting themes, which are related to the defined issue by their expected outcomes. The pupils' family or their specific interest in certain topics, not only historical ones, may also play a significant role in this area. At the end of the questionnaire, there was a section in which we collected basic demographic information about the pupils relevant to the evaluation of the questionnaires, to find out whether the passage they were working with was long or short for the pupils, and whether the research participants read books in their free time. We also investigated whether pupils would like to read the whole book from which the extract was excerpted. The year group of the respondents, not their age, is central to the evaluation of the questionnaires.

The research probe was carried out in one primary school in the Hradec Králové Region. Due to the pandemic of COVID-19, which was prevailing in the Czech Republic at the time of the research, the questionnaire was administered to the pupils without the presence of the author of the paper. Pupils from grades 6 and 9 filled in the questionnaire at school, while respondents from grades 7 and 8 were given the research instrument as part of distance learning, and thus filled it in without significant teacher intervention.

We are aware that the chosen method may have caused the respondents to have some difficulties in completing the questionnaire, for example due to misunderstanding of the questions and so on. Of course, the students could have addressed their questions to the teacher, but we perceive the absence of the author of the paper during the actual implementation of the research as a significant deficit. We emphasize that the methodology of the research investigation is presented completely, however, in the next part of the paper the results of the pupils from the eighth and ninth grade are presented.

2.1 Sample of respondents

A total of 12 pupils from the eighth grade (6 girls and 6 boys) and 18 pupils from the last year of primary education (9 girls and 9 boys) participated in the probing research.

3 Salt to the Sea

The eighth-grade students worked with an excerpt from Ruta Sepetys' book *Salt to the Sea* (2016). Multilateralism in the depiction of the events of the Shoah is represented by four characters whose fate is used to portray the life journey of people who lived through the Second World War in Nazi-occupied territory. The writer depicts the somewhat neglected lineage of wartime or post-war events through the figure of the consistent Nazi soldier, who is a typical representative of the German army during the Second World War, through the character of a young pregnant Polish girl who is forced to conceal her origins, the fate of a German soldier who 'woke up' during the German armies' rampage and decided to defect from the army, and through the depiction of a selected section of the life of a young Lithuanian girl who compares the effects of Hitler's and Stalin's policies in relation to the fate of Lithuania, then under the domination of the Soviet Union.

The story is set in the winter of 1945, a time when German soldiers are beginning to realize that the goals Adolf Hitler has set will not be achieved. Soviet troops are advancing from the east. Against the backdrop of these events, the inhabitants of the Nazi-occupied territory try to get out of the reach of the Russian soldiers, and these rescues include people against whom the Nazi policy was directed.

Sepetys was inspired by a real event, the sinking of the Wilhelm Gustloff, whose destruction was caused by Russian submarines operating in the Baltic Sea at the end of the Second World War.

As the author herself points out, the tragedy of this ship stands unjustly in the shadow of the sinking of the Titanic or the Lusitania, even though Russian destroyers caused the deaths of some nine thousand mostly civilians.

The multi-lateral view of selected events of the Second World War stands out from this publication, due to the excellent authorial intent, by looking at similar events through the focus of the four characters. Each person, influenced by his or her previous life, his or her pre-war experiences, his or her social position before and during the Second World War, or in connotation with his or her prospects, interprets the event in separate ways. It is on this point that we see a key aspect of why the book in question should be part of children's and adolescents' reading in literary representations of the events of the Shoah or the Holocaust.

The publication also highlights the different perceptions of Jewish people, with the most prominent being the different perspectives of Joana, a young Lithuanian woman, and Alfred, a confident and determined soldier in the Nazi army.

3.1 Results and discussion: 8th year

The eight grade research participants who worked with the excerpt from the publication answered six questions after receiving the excerpt. It can be concluded that all questions were directed towards drawing conclusions from the text read.

The first question was *Who is Florian?* The pupils wrote: "a German boy, probably a German deserter, who saved Emilie from the Russians; a German, a murderer; a Polish soldier, a German civilian". In most cases, pupils correctly identified Florian as a German soldier who had defected from the Nazi army. For the answers "Polish soldier" and "German civilian", respondents may have been mystified by Florian's efforts to blend in with ordinary people, civilians, and thus hide his military origins.

The second question - *When and during what did Emilia and Florian meet?* - was oriented towards the main idea of the demonstration, i.e., the situation when a German soldier (albeit a defector) saved a Polish girl, in Nazi terminology subhuman. All students answered like the line "they met in the forest when Florian was rescuing her", which shows their ability to understand even a largely unusually stratified narrative.

The third question - *What did you learn about Joan?* - was oriented to determine the recipients' ability to excerpt from the text information suitable for answering the postulated question. The pupils answered: "she was a girl who fled, worked in a hospital, her mother gave her shoes; she was from a wealthy family, she had her mother's shoes and worked in a hospital; she lost her mother when she fled Lithuania; her mother gave her shoes; she belongs to the refugees, she is from Lithuania; she fled with 15 refugees, she was from a wealthy family, when she and her mother fled Lithuania she stayed alone in Inserburg and she has not known about herself for 4 years".

The fourth question was asked as follows: *What is the relationship between Hannelore and Alfred?* To answer this question, the recipients had to correlate the information they had learned from various parts of the text, moreover, always viewed from a different focus, which entails the necessity not only to excerpt the required information, but also to connect and transform it into a more general level. All respondents wrote "partners" or "lovers". The high difficulty of the task can be demonstrated by the fact that a total of three pupils skipped the question, one wrote "don't know".

Penultimate question *In which part of the excerpt did you learn the most information about Florian?* was specifically aimed at determining the level of orientation in the text, since the most information about Florian is included in the section *Emilie* (second part). Respondents wrote: "in the last paragraph - Alfred; in the first part; in the section about Emilie (second

part)". The overwhelming majority of students answered correctly, which shows their ability to navigate the text, or their ability to understand the text and reflect critically on it.

The last question - *What do Alfred and Florian have in common?* was again included to determine the extent of the recipients' ability to draw inferences from the fiction text they read. All respondents wrote answers like "they were soldiers who sided with Germany", indicating their ability in the area.

The certain maturity of the class in the range of understanding the text, in the ability to interpret it, draw conclusions from it or navigate in a relatively complex narrative, is complemented by a total of 58 % of the respondents' choice of the option that they found the excerpt short, but this is not matched by only five choices of the option that they would like to read the whole book. Although respondents found the excerpt short, suggesting that they were interested in the narrative, only 42 % of students who had worked with the book chose the option that they would like to read the whole book. On the other hand, the choice of the option about the extent of the excerpt corresponds to a total of 8 responses (66.6 %) of pupils that they read books in their free time, which suggests that they are used to reading whole fiction narratives.

We are aware that due to the layout of the excerpt, which replicated the differentiation of the text in the publication, the reading of the excerpt may have been difficult for the students, especially because the narrative appears fragmented, which may have been difficult for the recipients in the eighth grade, given their presumed previous reading experience. Moreover, as mentioned above, the book is inspired by a real event in which thousands of civilians died: we assume that the research participants from the given year of the lower-secondary school do not yet possess sufficient factual knowledge, which is essential in the reception of such texts. Despite the considerable cognitive demand of the narrative in terms of its reception, the results of the probing survey point to the fact that students from the eighth grade can interpret this narrative in a complex way. As the results of the research pointed out, the key factor for a comprehensive reception of the publication *Salt to the Sea* is sufficient mastery of critical thinking methods.

4 Between Shades of Gray

Ruta Sepetys's publication *Between Shades of Gray* (2020) falls into the area of a multilateral view of one line of events of the Second World War in looking at the Nazi regime and its representatives as saviors from the domination of the Soviet Union in Lithuania. The narrative itself describes the process of "liberation" of Lithuania by the helpers - the Nazis. The family of the main character, Lina, experiences persecution by the Soviet army under Stalin's leadership. The process of eliminating inconvenient people (especially the so-called intelligentsia) is comparable to what the leaders of the National Socialist German Workers' Party perpetrated on selected national groups. Lin's family is evicted from their apartment in Vilnius and deported in cattle cars to the Siberian Gulag.

In Siberia, internees are forced to work slavishly: without work, they receive neither meagre food rations nor firewood: in winter, temperatures in this region fall well below freezing. The author portrays the issues of the Soviet concentration camps through the stories of individuals, Lina's family, and the people Lina meets on the way to the gulag or in the gulag itself. The presentation of forced internment under various totalitarian regimes through the life story of specific individuals is currently one of the most popular methods of introducing these events not only to pupils and students at various levels of institutional education. We are convinced that this approach can be applied to a wide variety of events that must be warned against to avoid their repetition and to be able to recognize their germs.

Multilateralism in the Shoah is represented by a different view of the Nazi regime's supporters, specifically its army. The inhabitants of the Baltic countries and Finland view it as their

saviors from Soviet terror, as their liberators. This fact is quite understandable: the inhabitants of these countries have felt the persecutory practices of the Soviet Union, and so far, they have only learned about the actions of the German army by hearsay, and from their assumptions they mainly excerpt the fact that Hitler's troops were strongly opposed to communism. They have not yet heard of the Nazi extermination policy directed against persons of Jewish nationality; a case they consider marginal because the majority Baltic society is not among the active practitioners of Judaism.

We are convinced that the publication falls within the area of a multifaceted view of the Shoah, because in a way it disrupts the view of the Nazis primarily as a source of evil; in Sepetys' publication they are paradoxically seen as saviors and liberators. Of course, it is important to relate this point of view to the historical and social relations between the Baltic States, Finland, and the Soviet Union. This point of view can also be transferred to the perception of the soldiers of the Soviet army, who, in a way, form a contrast to the German army in *Between Shades of Gray*. This view can, with a certain degree of simplification, be compared to the perception of the Nazis in the Protectorate of Bohemia and Moravia and the Soviet soldiers as liberators.

4.1 Results and discussion: 9th year

As part of a probing research inquiry, students answered questions that stemmed from a passage at the heart of which is a situation from a cattle car transporting selected people to Siberia. The extract paints a picture of confusion represented by a dead child and his mother's efforts to cope with the situation, with the help of the other passengers in the wagon. The second part of the excerpt, with which the pupils participating in the probing research investigation worked, demonstrates the uncertainty associated with the arrival of Hitler's troops in Lithuania. The passengers develop two views: the first perceives Hitler as a savior, the second perceives Nazism as a successor to Soviet terror, with one totalitarian regime replacing the other, and it cannot be said that one is better or worse than the other.

The first question related to the excerpt from *Between Shades of Gray* was about the application of what was read to the lives of the recipients. The students were asked to answer the question *How do you imagine life in the grey tones?* Pupils wrote: "life during the Second World War; devastating; cramped; life in fear; life without rights, without power; harsh and dangerous; that people were oppressed, had to hide". As can be seen from the above, the research participants from the ninth grade were inspired by reading the excerpt rather than relating the phrase "life in grey tones" to their own lives, to their subjective perceptions.

Two questions were oriented towards excerpting information from the narrative: *What did you learn about Andrius?* and *Who is the narrator of the story?* To the first question, respondents answered "he was strict; a friend of his mother; he protected his family; he was brave; he had bruises on his face; he was a prisoner in the gulag; he was aggressive; he liked to cause conflict". The pupils' responses are widely dispersed, especially as the sample thematizes a considerable amount of information that respondents could have recorded in their answer to this question. Within the second query we encounter the replicas: "the woman; Andrius; she; the daughter of Jonas". Most of the answers referred to Ona, the girl who lost her child.

The fourth question was directed at the comparison between the Stalinist regime and Nazism. Based on the reception of the demonstration, students were asked to answer the question *What do the Soviets (Stalin) and Hitler (Nazis) have in common according to the demonstration?* Pupils from ninth grade wrote: "they make trouble; nothing; cruelty, horror, brutality; they cooperate in war". The lack of factual knowledge that ninth grade pupils should have at the theoretical level is indicated by one "don't know" response and a total of six pupils who omitted this question.

Comparing the responses of pupils from eight grade with the responses of the ninth-grade readers, it can be concluded that the pupils from the lower grade show a higher level of knowledge based on the evaluation of the questionnaire items that were in some way related to determining the level of knowledge about historical and social aspects related to the Second World War. We are aware that our statements cannot be generalized, as the respondents' answers could have been influenced by many internal and external factors.

The penultimate question was directed at correlating what was read with the existing factual knowledge of ninth-grade pupils: *Where and when might the story take place? According to what do you think?* Pupils answered: "in the Second World War; in Russia during the Second World War; at a railway station during the Second World War (talking about Hitler); on a train during the war; in a house; probably the First or Second World War; in Lithuania in the Soviet Union in 1943". The responses to this question demonstrate a certain lack of factual knowledge on the part of these recipients, as discussed in more detail in the previous commentary. It is worth noting the considerable dispersion of pupils' responses in terms of the correct and inferior temporal (and local) placement of the plot of the excerpt. In this sense, we encounter quite detailed answers (see "in Lithuania in the Soviet Union in 1943"); on the other hand, some respondents entered "in a house" or the general, though correct, statement "during the Second World War".

The last question again focused on the ability to extract information from the text about who killed Andrius. Respondents entered "Soviet soldiers; Germans and Russians; no one; either the bald man or the Germans; Ona". As can be seen from the above replicas, pupils had considerable difficulty in extracting relevant information from the text relating to the question. This fact may be due to the complicated narrative structure to which pupils may not be accustomed; they have probably not yet encountered the corresponding fiction patterns, which is also related to the relatively balanced scores in the responses to the question whether respondents considered the passage to be short or long. A total of eight pupils (44 %) chose the first option, while a total of seven respondents (39 %) chose the second option. Three pupils chose the "don't know" option.

The fact that only 55 % of the respondents in this year group read books in their free time cooperates with a certain absence of fiction models and the related lack of reading competence. The possibility that this group of respondents would like to read the book from which the excerpt that was part of the questionnaire they completed was even less likely to have a positive response (44.4 %).

5 Conclusion

In this paper, we present selected results of a probing research investigation, which investigated the degree of reception and interpretation of selected fictional narratives in which a multilateral view of the events of the Shoah or the Holocaust is applied.

Students from the eighth grade answered questions based on an excerpt from the publication *Salt to the Sea*. The reception of this text caused difficulties for a certain group of pupils evaluated, which stemmed from the need to generalize in a certain way the different views of the same event and to answer the postulated questions based on a certain generalization. What was unexpected was the finding that the pupils from this grade had sufficient knowledge of the historical phase of the Second World War.

Given the fact that the pupils who worked with the excerpt from *Between Shades of Gray* were in their final year of primary institutional education at the time of the probing research, we assumed that this group of test pupils would have a sufficient command of critical thinking methods or text-orientation skills. Based on this thesis, the questions postulated for pupils from ninth grade were quite challenging. It is beyond the power of the

researcher to ascertain the extent to which pupils did not understand the question, did not want to answer it, or did not master the assumed competencies. For questions related to comprehension of the text and drawing inferences from what was read, pupils were unable to answer adequately in most cases. For questions centered on establishing the knowledge of the sample of respondents about the Second World War, pupils again did not answer satisfactorily - it can be concluded that pupils from the previous year had a greater amount of factual knowledge. Despite some dispersion between the theoretical potential of the publication in presenting a literary representation of a multilateral view of the events of one line of the Second World War and the results of the research investigation, we believe that the publication by Ruta Sepetysová could be familiarized with by pupils from the ninth grade, since on a theoretical level they should already have sufficient reading experience and factual knowledge by this time.

The publications included in the questionnaires are non-intentional. We believe that this fact should not be an argument for why the selected students failed to answer the postulated questions, especially those that focused on skills related to critical thinking, comprehension, and orientation in the text. Leaving aside the plot of the narrative, it can be said that the pupils who took part in the probing research should have mastered these techniques and should be able to apply them to any text (considering its content, of course). Another argument why we do not consider the selection of non-intentional texts as a certain limit is the fact that pupils in institutional education in literary education classes are introduced through reading books to texts that can be classified as literature not primarily intended for children and young people (compare Mašát, 2019).

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POLYGRAPH EXAMINATION IN THE CONTEXT OF EXPERT EVIDENCE IN CRIMINAL PROCEEDINGS

^aTOMÁŠ NOSEK, ^bMAREK VOCHOZKA,
^cANTONÍN STANISLAV, ^dLIBUŠE TURINSKÁ

*Institute of Technology and Business in České Budějovice,
Okružní 517/10, 370 01 České Budějovice
Email: ^anosek@mail.vstecb.cz, ^bvochozka@mail.vstecb.cz,
^c30141@mail.vstecb.cz, ^dturinska@mail.vstecb.cz*

Abstract: The article describes the current legal status of the polygraph examination method in the context of expert evidence in criminal proceedings in the Czech Republic, England, and Wales, with a focus on the method of language interpretation. The aim of the article is to provide a description of the existing knowledge as well as the valid and effective legislation and case law in the field of expert proof in criminal cases. The basic research design is to use the language interpretation method to describe the current law and the case law of the Polygraph Examination Method, considering the Guideline for Evaluative Reporting in Forensic Science (2015) and guidelines for best practice in forensic science and the European Network of Forensic Science Institutes (ENFSI) for expert assessment of forensic sciences.

Keywords: Law, polygraph, lie detection, expert evidence, criminal proceedings, code of criminal procedure, physiological responses, criminal law regulation.

1 Introduction

In the Czech Republic, the method of polygraph examination, i.e. instrumental sensing, recording, and evaluation of physiological values (Dohnalová and Štěpánková, 2019), started to be used in criminal proceedings in the early 1980s. The workplace of polygraph examination has consolidated and built its position within police forces; up until now, polygraph examination is carried out at the Institute of Criminology, where the application of this method has been tested in practice.

In terms of competence, (within) the Police of the Czech Republic, even after the amendment of the Act on Experts and the implementing provisions (Act No. 254/2019 Coll. On Experts, Expert Offices and Expert Institutes; Decree No. 503/2020 Coll. On implementing the expert activities; Decree No. 504/2020 Coll., on remuneration for expert activity; Decree No. 505/2020 Coll., which sets out a list of expert disciplines in the individual branches of expertise, other certificates of professional competence, certificates issued by professional chambers and specialization studies for disciplines and branches of expertise; Decree No. 370/2022 Coll., which amends Decree No. 504/2020 Coll., on remuneration for expert activity), even in 2023, polygraph examination shall be carried out exclusively at the Institute of Criminology and only for the purposes of criminal proceedings. The scope of jurisdiction to carry out the examination is governed by the binding regulation of the President of the Police No. 77/2009 Coll., which regulates the subject matter, functional, and local jurisdiction of the expert departments of the Police of the Czech Republic, which specifies the focus and goal of the polygraph examination. This examination is executed for the bodies of the Police of the Czech Republic and law enforcement authorities (both departmental and non-departmental). The output of the examination in the written form is the Report on the Performance and the Result of Polygraph Examination (Dohnalová and Štěpánková, 2019; Annex to the binding regulation of the President of the Police, 2009).

The procedural aspect of the application of polygraph examination is not regulated by a separate legal norm but the basis could be the provisions of the Criminal Code (Section 89 (2) of the Act No. 141/1961 Coll., on Criminal Court Proceedings (Criminal Code), as amended, when *“anything that can contribute to the clarification of a given matter can serve as evidence, in particular the testimony of the defendant or witnesses, expert opinions, things and documents that are of importance for criminal proceedings and investigation.”* Given that in the Criminal Code, evidence is listed only

demonstratively, the result of a polygraph examination cannot be excluded through the interpretation of this provision.

The goal of the paper is thus to provide a description of valid and effective legislation and case law of the polygraph examination method in the context of expert evidence in criminal proceedings. As part of the goal, there will be a primary comparison of the position of the polygraph examination method in the legal system of the Czech Republic, England, and Wales (Kotsoglou and Oswald, 2021). In conclusion, the analysis of the current legal status of the polygraph test as part of expert evidence within the limits of an objective teleological and axiological interpretation (Melzer, 2011), taking into account the Guideline for Evaluative Reporting in Forensic Science (2015) and guidelines for best practice in forensic science and the European Network of Forensic Science Institutes for expert assessment in forensic science, which is used both for improving the quality of forensic science in European countries and exchange of information in forensic science (Fürst, Šímková, Zimmer, and Fürstová, 2022).

The basic research question is thus formulated as follows:

(a) What is the current legal status of the polygraph examination method in the context of expert evidence in criminal proceedings in the CR within the limits of an objective teleological and axiological interpretation?

In terms of evidence, the polygraph examination method within the decision-making practice of courts has an unclear position, which will be specified using an objective teleological and axiological interpretation.

2 Literary research

Expertise, or expert activity, is used at the moment when general knowledge in a field is no longer sufficient and the given field has advanced to such an extent that specialization is necessary (Křístek, Bürger and Vučkay, 2021). For each such field, this occurs at a different time. From the perspective of science, there is thus no single universal moment. Dörfl, Krysl, Lehká and Visinger (2021) state that evidence through expert opinion is a complex process in which the established procedure and rules need to be respected and the legal formal requirements need to be met so that the application of expert opinion or expert statement is following with the procedural rights of the participants and the principle of a fair trial is fulfilled. Expert opinion needs to be seen as a means of expressing professional conclusions on the facts the experts were supposed to clarify in this way (Vacura, 1976).

Evidence, including expert evidence, is a comprehensive set of procedures in criminal proceedings, which includes theoretical professional knowledge and many years of practical experience of law enforcement authorities, including other entities (Baláž and Palkovič, 2005). The legal status of the polygraph examination method in the Czech Republic, England, and Wales is the subject of this paper. As an example, Paul, Fisher and Voigt (2020) state that although providing material and visual results, in the German legal system, a polygraph examination is classified as part of expert opinion and cannot be considered separate evidence, which, in legal terms, corresponds to the Czech legal status of this polygraph examination method, according to which its conclusion must be recognised as supporting evidence combined with other evidence in a complex chain, not as separate evidence or the only evidence (§ 89 of the Code of Criminal Procedure, Dohnalová and Štěpánková, 2019).

In contrast, in the guidelines for polygraph examination in England and Wales (Polygraph Examination Instructions, PEI), Kotsoglou and Oswald (2021) state that the evidence obtained

through the application of the polygraph examination method should be considered low-weight and inconclusive by the court compared to the information obtained through questioning. Furthermore, Kotsoglou (2021) argues that the polygraph examination method cannot be standardized due to the complexity of the interview as a discursive phenomenon and its application is a low point in the long-term effort to ensure that the criminal justice system adheres to its own promulgated principles. The lack of standardization requires ad-hoc improvisation, which means that the term “test” is actually a misnomer.

The polygraph examination method is based on the assumption that emotional responses (Ekman, 2016) associated with false testimony cause significant physiological changes and behaviour with limited conscious control. Emotional distress triggers specific changes in the activity of parasympathetic and sympathetic systems, which are key for detecting false responses and misrepresenting information. Lying, or actively suppressing the truth in order to appear innocent often requires a significant amount of concurrent mental processes (Palen et al., 2021; Verschueren et al., 2021). Moreover, lying requires greater cognitive effort than speaking the truth (Sandham, et al., 2021; Nahari et al., 2019; Geven et al., 2018). Neurocognitive research confirms that both suppressing the truth and fabricating lies are manifested by increased activation of specific brain regions responsible for cognitive control (Koller et al., 2022; Geven, et al., 2018).

In addition to polygraph examination, there has recently been conducted research on lie detection using speech content analysis (Vrij, Fisher, Leal, 2022; Nahari et al., 2019), EEG analysis (Abdulaziz Alarfaj, Abeer, 2022; Hanan Ahmed Hosni Mahmoud, 2022), and scientific research verifying the validity of lie and truth detection principles (Mac Giolla et al, 2021; Vrij, 2019; Klein Selle et al., 2018; Klein Selle et al., 2018) and their application in the field of criminal law. The purpose and importance of evidence consist in the fact that it is the only way to procure the factual basis for a decision that can be and must be procured by law enforcement authorities (Fryšták, 2021).

The goal of the paper is a primary description of the existing knowledge as well as the valid and effective legislation (Act No. 254/2019 Coll., On Experts, Expert Offices and Expert Institutes and implementation regulations; Act No. 141/1961 Coll., On Criminal Procedure (Code of Criminal Procedure); Act No. 40/2009 Coll., Criminal Code) and case law in the field of expert evidence in criminal proceedings, with a focus on the method of polygraph examination and its application in the context of evidence in criminal proceedings.

For the purposes of this paper, a basic comparison of differences in the position of the polygraph examination method in the legal systems of the Czech Republic and Great Britain will be carried out. The next part of the paper focuses on the analysis of the current legal status of the polygraph examination method in the context of expert evidence using the method of objective teleological and axiological interpretation (Melzer, 2011) while considering the Guideline for Evaluative Reporting in Forensic Science (2015) and best practice in forensic science and the European Network of Forensic Science Institutes ENFSI (Fürst, Šímková, Zimmer and Fürstová, 2022).

3 Data and methods

The basic research design is to use the method of language interpretation to describe the current legal status and case law of the Czech Republic in the context of evidence using the method of polygraph examination and the comparison of differences in the legal regulation of the polygraph examination method in the Czech Republic, England, and Wales. Using objective teleological and axiological interpretation (Melzer, 2011), an analysis of the current legal status of the polygraph examination method in the context of expert evidence in the CR (as a method

to measure the basic physiological responses measured within the polygraph examination) will be performed.

The classification of a polygraph examination as a criminalistic method admissible in criminal evidence is based on the criminalistic-systemic approach (Bradáč, 1997). This approach is based on the assumption that an offender when committing a crime acts on the environment in which they commit the crime, and the environment acts on them. This interaction enables the determination of a number of parameters (in our case, the basic physiological responses) that subsequently characterize the offender and form a basis for the final identification of the offender and the assessment of the credibility of statements and testimonies.

This systemic approach will be the basis for performing the analysis of the legal status of polygraph examination using the method of objective teleological and axiological interpretation while considering the Guideline for Evaluative Reporting in Forensic Science (2015) and best practice in forensic science and the European Network of Forensic Science Institutes (ENFSI) for expert assessment in forensic science (Fürst, Šímková, Zimmer and Fürstová, 2022).

As for objective teleological interpretation, the purpose is of particular importance, as it is the driving force in lawmaking. Its existence is even a prerequisite for legal law-making. The argumentation through the purpose of the interpreted statement is primarily based on whether the interpreted statement is unclear (in our case, in terms of the legal status of the polygraph examination method within evidence) and at the same time, whether the purpose to be achieved is known. The method of objective teleological and axiological interpretation is value-neutral and can thus be used to achieve an objective recent interpretative goal that allows adapting the valid and effective law to changing objective conditions even without the intervention of legislators (Melzer, 2011).

4 Evidence in criminal proceedings in the Czech Republic

The amendment to the Code of Criminal Procedure by the Act No. 265/2001 Coll. repealed the legal regulation on when an expert opinion must be requested and the specification of simple cases when a specialist statement is sufficient. The amendment modifies the issue of expertness in criminal proceedings as follows: “*Expert opinion is requested if specialist statement is not sufficient due to the complexity of the issue being assessed*” (§ 105 (1) of the Code of Criminal Procedure). However, this modification does not always apply, namely in cases where the engagement of an expert is requested by the Code of Criminal Procedure and in cases of expert opinions on medical conditions, which cannot be prepared without prior examination of medical documentation by an expert (§ 105 of the Code of Criminal Procedure; Šámal, 2013).

The main goal of executing expert activity is thus to present expert conclusions on a disputed factual issue in the form of an expert opinion. The activity is primarily focused on expert evidence in criminal proceedings, the principles of asking questions to experts, and the systemic prerequisites of expert activity.

In addition to decision-making, evidence is one of the most important procedural activities of law enforcement activities, as it enables the determination of the factual basis for decision-making so that the goal of criminal proceedings is achieved (§ 1 of the Code of Criminal Procedure; Fryšták, 2021). The primary goal, in accordance with the law, is to detect the perpetrator (§ 113 of the Code of Criminal Procedure), who fulfils the characteristics of a crime under substantive criminal law, to investigate the crime, and to bring the accused to the court that shall decide on guilt or innocence; if the person is found guilty, to impose a penalty, a protective measure, or to waive the punishment. Subsequently, the execution of the sentence or protective measure is carried out, if imposed by the court. The

goal of criminal proceedings is not only “the fair punishment of the perpetrator” but also the execution of a due process of law (Sections 1 and 36 of the Charter of Fundamental Rights and Freedoms and case law of the Constitutional Court). In accordance with this goal, the goals of criminal proceedings are also specified, mainly the truthful establishment of the facts, the conviction of the perpetrator, and the imposition of adequate punishment or waiving of punishment (Šámal, 2013).

Depending on the nature of a given case, the goal can also be the imposition of protective measures on the person involved, the accused, or a decision on non-pecuniary damage, restitution for unjust enrichment in adhesion procedure, or a decision on compensation for damages. The objectives of criminal proceedings (submitted to law enforcement authorities in accordance with § 12 (1) of the Code of Criminal Procedure) are intertwined, complementary, and connected to each other so that the goal of the criminal proceedings is achieved. Besides the decisions of the general courts, i.e., the national case law, international standards need to be considered, which are represented by the decisions of the European Court of Human Rights and the Convention for the Protection of Human Rights and Fundamental Freedoms (Fryšták, 2021).

5 Evidence as activity closely related to criminalistics

Criminalistics analyses the principles of the origin, duration, and termination of traces of crime, significant information, and forensic evidence in order to protect citizens and the state against crimes and develops practices or methods that lead to successful prevention and detection of crime (Musil, Kratochvíl, Šámal et al., 2007). As a forensic discipline, criminalistics develops practices and methods that would lead to the prevention, investigation, and detection of crime by applying the knowledge of natural and technical sciences in order to fight against crime (Musil, Kratochvíl, Šámal et al., 2007; Musil, Konrád and Suchánek, 2004). Procedural legal regulations in relation to criminalistic procedures, methods, and technical means are set out in the Code of Criminal Procedure but are often only framework or not regulated at all (they are often regulated in internal acts of the Police of the Czech Republic, such as the binding directive of the President of the Police of the Czech Republic No. 100/2001, on criminalistic-technical activities of the Police of the Czech Republic, or the binding directive No. 313/2017, on scent identification) (Fryšták, 2021).

Legal and admissible criminalistic methods for practice are considered only those meeting the following criteria (Pješčak et al., 1981):

- a) They are objectively competent, strictly scientific in nature, thus leading to the knowledge of objective truth in criminal proceedings,
- b) They can be used to evaluate the facts being evidenced as well as the legality of the procedure according to the generally applicable principles of criminal proceedings,
- c) They are used to obtain or verify new or existing facts that are important from the perspective of criminal law,
- d) They are not expressly forbidden in the Code of Criminal Procedure and are based on its fundamental principles,
- e) The implementation of these methods complies with the guarantees explicitly provided for by the Code of Criminal Procedure on ensuring the legality of implementing similar acts explicitly specified in the Code of Criminal Procedure (“...in particular, the guarantee to ensure the right of the defendant to defence” Fryšták, 2021).

6 Use of polygraph examination in criminal proceedings in the Czech Republic

Information about the successful application of a lie detector in the USA was not unnoticed even in Czechoslovakia, where the term “lie detector” was first used in the professional literature in 1937 in the article by Karl Kent in the third issue of the journal Czechoslovakian detective (Kohout, 2008). Nowadays, the method of polygraph examination is popular in the field of law,

in the process of personality traits studies, including fundamental research (Iacono, Ben-Shakhar, 2019; Kosyanova, 2014). In the Czech Republic, the method of polygraph examination (measuring and recording physiological responses – polygraph interrogation) started to be used in criminal proceedings at the beginning of the 1980s. The early 1990s are associated with a sharp increase in crime related to the social events of that period in the CR, which was also reflected in an increased number of requests for conducting a polygraph examination. In this period, the highest percentage of requests was recorded within the operational and investigation activities of the police and reports on the execution of polygraph examinations had a character of supporting operational material. With the gradual increase in the number of requests for conducting this examination after the initiation of criminal prosecution, the results of polygraph examination have become a part of case files and were consulted with prosecutors, who subsequently evaluated them during the preparation of indictment (Dohnalová and Štěpánková, 2019). This method and its further development are similarly addressed in other states as well (Iacono, Ben-Shakhar, 2019). The number of requests for polygraph examination nearly tripled in the years 2005–2014, with the lecturing activities of polygraph examiners in the police environment as well as on the premises of other institutions and bodies playing a significant role. The fact that polygraph examination is required by “new policemen” around 2010, there was a very rapid generational turnover of experienced criminologists, who had been using this method since its implementation, had also a significant impact on the increasing number of requests. The trend of the growing number of requests for polygraph examination is also recorded in the field of financial and economic crime and cybercrime (Dohnalová and Štěpánková, 2019).

In the context of legislation, the following factors need to be comprehensively included in the area of polygraph examination (Dohnalová and Štěpánková, 2019):

- a) jurisdiction,
- b) procedural status,
- c) indictment, judgment, resolution,
- d) psychological assessment,
- e) processing,
- f) Act no. 361/2003 Coll., on the Service of Members of the Security Corps.

In terms of jurisdiction, the Police of the Czech Republic carries out polygraph examinations only at the Criminalistic Institute and exclusively for the purposes of criminal proceedings. The scope of jurisdiction to carry out the examination is governed by the binding directive of the President of the Police No. 77/2009, which defines the focus and objective of a polygraph examination. This examination is carried out for the needs of the Police of the Czech Republic and legal enforcement authorities (departmental and non-departmental). The written output of the examination is the Report on the Performance and the Result of Polygraph Examination (Report on the Performance and the Result of Polygraph Examination; annex to the Directive of the President of the Police). The procedural aspect of the application of a polygraph examination is not regulated by a separate legal norm but it is based on the provisions of the Code of Criminal Procedure, according to which “*everything that can contribute to the clarification of the case being investigated, in particular the testimony and statements of the accused and witnesses, expert opinions, objects and documents relevant for the criminal proceedings and examination may serve as evidence*” (§ 89 (2) of the Code of Criminal Procedure; Dohnalová and Štěpánková, 2019).

Since the Code of Criminal Procedure provides only an indicative list of evidence, it is not possible to exclude the result of a polygraph examination by interpreting this provision. There have been cases when the result of a polygraph examination was considered by the court as other documentary or indirect evidence, or it was stated by the court that the method used had contributed to the conviction of the suspect or the clarification of a given case. The result of

polygraph examination was recognised as corroborative evidence combined with other evidence to make a coherent chain, not as the only or separate evidence (§ 89 (2) of the Code of Criminal Procedure; Dohnalová and Štěpánková, 2019).

This approach is fully applied in accordance with the principle of free evaluation of evidence, since it is not possible to ignore the statement of the Supreme Court of the CR, according to which *"The results of the so-called lie detector test cannot be used by the court as evidence in deciding a criminal case"* (Collection of Judicial Decisions and Statements of the Supreme Court of the Czech republic/Collection of decisions of the judicial authorities The Supreme court of Czech republic no. 8/1993). Other judgments are judgments of the courts of first instance (Dohnalová and Štěpánková, 2019):

- a) *"This documentary evidence closes the circle of indirect evidence that represents a coherent and undisturbed chain"* (Judgment of the Regional Court in České Budějovice 16 T 32/2006),
- b) *"Documentary evidence also includes a report on polygraph examination of the defendant based on which he/she was "convicted"* (Judgment of the Regional Court in Hradec Králové 4 T 85/94),
- c) *"...conclusions drawn on the basis of the evidence taken fully correspond with the conclusions ad results of the polygraph examination..."* (Judgment of the Regional Court in Ústí nad Labem 28 T 3/94),
- d) *"In addition to the aforementioned evidence, the court had based its decision also on the results of the polygraph examination of the defendant" ... "The court believes that the results of the polygraph examination of the accused had led to the detention of the accused. The court is aware of the fact that these results cannot be the only evidence on the defendant's guilt or innocence but can be used as other evidence."* (Judgment of the Regional Court in Hradec Králové 7 T 9/2009)

Furthermore, it is necessary to present the decisions of the Court of Appeal and the resolutions of the Police (Dohnalová and Štěpánková, 2019):

- a) *"...the results of the polygraph examination are currently not considered even indirect evidence but rather a clue and certain guidance for law enforcement authorities, mainly in preparatory proceedings."* (Judgment of the High Court in Prague 7 To 88/2009)
- b) *"Based on the gathered documentation, the interrogation conducted, and in particular based on the contribution of the conducted polygraph examination, ... the informant voluntarily presented themselves at Criminal Police and Investigation Department (SKPV) and supplemented the initial statement there in accordance with § 158 (6) of the Code of Criminal Procedure..."* (Resolution of the Police of the CR, Regional Police Directorate, the Central Bohemian Region, SKPV OOK ÚO Kladno).

"Increasing probative value" of the result of the polygraph examination (also known as "processing"), one of the possibilities, is its incorporation into a psychological expert opinion (Dohnalová and Štěpánková, 2019):

- a) *"Given the results of the polygraph examination and psychological examination, it is very likely that the special credibility, i.e., the credibility of the statements, is also reduced."* (EO in the field of health care, psychiatry, specialisation: clinical and forensic psychology, the Police of the Czech Republic, Central Bohemia Region)
- b) *Polygraph examination recorded a number of responses that call into question the answers of the examined person to the questions directly related to the crime. Based on the results, it clearly shows that the examined person was particularly tense when answering the questions concerning the circumstances of the assault on the victim, the meeting with the witness, and handing*

over the jewellery. The low values of emotional strain measured on indifferent topics are in contrast with the measured values on the questions where the answers can be considered threatening to the interviewee." (EO in the field of health care, clinical psychology, the Police of the Czech Republic, Ústí nad Labem)

Act no. 361/2003 Coll., on the Service of Members of the Security Corps (§ 92 f) also states that " ...The officer shall: ... take a polygraph examination at the request of a service official..., if required so by the important interest of the service."

7 Polygraph examination in England and Wales

Under the Offender Management Act, 2007, Her Majesty's Prison and Probation Service (hereinafter also referred to as "HMPPS") currently uses polygraph tests in order to monitor sex offenders, both post-conviction and post-traumatic, which is typical mainly for the USA as the so-called Post Conviction Sex Offender Testing (hereinafter also referred to as "PCSOT") (Grubin et al., 2023), and especially to monitor those released on licence and to manage compliance with their licence conditions. The scope of the polygraph test is expected to be extended by similar provisions of the Domestic Abuse Act, 2020, and the Anti-Terrorism Act. The second bill also includes polygraph testing as a method of monitoring compliance with Terrorism Prevention and Investigation Measures (hereinafter also referred to as "TPIM") and leaves open the possibility that statements made during the compulsory polygraph testing may be used to secure a TPIM following the end of an offender's licence (Hall, 2020; Kotsoglou and Oswald, 2021). As an alternative, oculomotor deception testing was tested in the USA, which uses the method of cognitive load to assess the credibility of offenders (Mundt, Smith and Ambroziak, 2022).

In England and Wales, Kotsoglou and Oswald (2021) base their investigation of arguments used by polygraph proponents and deployers on the following rationales and arguments, which can be divided into the following main categories:

- a) The utility argument – the polygraph examination is used only for obtaining other information that needs to be considered,
- b) The argument of corroboration rule – the result of a polygraph examination is additional information that needs to be taken into account,
- c) The non-oppression argument – besides detecting false statements, the interviewed person can freely decide to provide information without being subject to any form of oppressive behaviour,
- d) The containment argument – concerns related to the application of the polygraph examination from a criminal justice evidential perspective cannot be used in the context of probation, investigation, or TPIM,
- e) The expertise argument – persons that are trained in using a legitimate and valid (scientific) method are highly regulated by legislation,
- f) Argument on human rights – although articles on human rights can be used, any infringement can be justified.

According to ACPO (the Association of Chief Police Officers) from 2013, there are three types of circumstances under which an investigation can be frustrated:

- a) If someone has been eliminated from the examination as a direct use of a polygraph or on the basis of lines of enquiry following a polygraph test. It could be argued that the examination was flawed because of excessive reliance on invalid techniques,
- b) If a suspect is implicated from polygraph evidence, it could be argued that the investigation followed the lines of enquiry strongly influenced by "confirmation bias" on the basis of faulty technology,

- c) If a victim of a crime is considered untrustworthy on the basis of the polygraph test, it would be a mistake to merely drop those enquiries.

The ACPO further states that there are no typical clues to detect a lie, whether through non-verbal behaviour, verbal behaviour, or physiology, which can be used in the criminal justice system of the UK to distinguish between a lie and truth consistently and accurately. Furthermore, it is stated that it is the responsibility of the competent authorities to decide on which methods to use in the field of policing and which do not fall in the context of an investigation or security clearance, provided that information obtained through their application is not part of a chain of evidence.

In this field, the legislative framework includes Polygraph Rules (2009), which govern the qualification of polygraph examiners trained by the accredited American Polygraph Association, as well as the administration and control of the test, and, most importantly, the ways in which the results are interpreted to the offenders and their legal representatives.

As Kotsogolou (2021) states, in terms of the deception in the polygraph examination, it is highly unlikely that confessions obtained based on the polygraph examination would survive the two-stage reasoning process of a judge of a criminal court (Section 76 (2) and 78 PSACE). Defence counsels tend to rely on because the courts have not clearly specified which sections their decision to exclude the given confession is based on. It is only required that the breach of provisions is "significant and substantial". It shall also be noted that Section 76 (2) a) PSACE, which has replaced the rule of voluntariness at common law, separating the veracity of the confession from its legitimacy. A sharp reaction of polygraph proponents would focus on the meaning of "oppression". The remit of "oppression", which is partly defined in Section 76 (8) PSACE, includes deception. The question thus is whether it can be said that there is necessary quality and availability of law governing the use of polygraph examination and whether the interference with Section 8 was in accordance with the law. The Court of Appeal in Bridges accepted a "relativist approach" to the quality of the law, stating that the more serious the qualifying offence, the more precise and specific the law must be to justify it. (2020 EWCA Civ 1058, (83))

8 Conclusions

Qualified objective teleological interpretation of the legal status of polygraph examination in the Czech Republic

In the context of a qualified objective teleological interpretation, this chapter deals with the purpose of the legal regulation in the Czech Republic, since the purpose of the interpreted provision cannot usually be derived directly from the wording of the law (cf. the introductory provision in § 1 of the Act No. 111/1998 Coll. On Higher Education Institutions and on Amendments to Other Acts – the Higher Education Act), since the rule of interpretation, which is currently a legislative commonplace specified in the Government's Legislative Rules (Section 39 (1)) states that *lex moneat, non doceat* (the law warns, not teaches) (Melzer; 2011).

Based on the above, it is possible to determine the legal purpose and answer the research question: "What is the current legal status of the polygraph examination method in the context of expert evidence in criminal proceedings in the CR within the limits of objective teleological and axiological interpretation?"

(a) The Czech Republic and the legal status of polygraph examination within the limits of objective teleological interpretation

It is necessary to follow up mainly on the primary mechanism of criminal law regulation, i.e., to highlight the fundamental and essential vagueness of the legal regulation of the polygraph examination method. The procedural aspect of the

application of polygraph examination is not regulated by any separate legal norm. Therefore, it is only possible to draw on the provisions of the Code of Criminal Procedure, according to which "anything that can contribute to the clarification of a given matter can serve as evidence, in particular the testimony of the defendant or witnesses, expert opinions, things and documents that are of importance for criminal proceedings and investigation" (§ 89 (2) of the Code of Criminal Procedure; Dohnalová and Štěpánková, 2019). Furthermore, it is necessary to proceed from the purpose of criminal proceedings, which is based on the fundamental principle that the primary purpose is not only "the just punishment of the offender", but also due process (Sections 1 and 36 of the Charter of Fundamental Rights and Freedoms and the case law of the Constitutional Court). In accordance with this purpose, the objectives of criminal proceedings are also determined, especially the truthful establishment of the facts, the conviction of the actual perpetrator, and the imposition of an appropriate punishment or waiver of punishment (Šámal, 2013).

If proceeding only from § 89 (2) of the Code of Criminal Procedure, in terms of the purpose of the provision, polygraph examination could be considered equal to other independent evidence in judicial decision-making. However, it is also necessary to consider the following factors (in particular, the legal regulation of the purpose of the criminal proceedings, the case law, and decisions of courts) significantly affecting the purpose of the polygraph examination as expert evidence:

- 1) Jurisprudential nature of decision-making within polygraph examination - "This documentary evidence closes the circle of indirect evidence which forms a complete and undistorted chain." (Judgment of the Regional Court in České Budějovice 16 T 32/2006),
- 2) Due process of law (Sections 1 and 36 of the Charter of Fundamental Rights and Freedoms and the case law of the Constitutional Court) – the procedural aspect of the use of polygraph examination is not regulated by any separate legal norm.
- 3) Polygraph examination method is not sufficiently and legally defined and examined. The correct methodological procedure defined by Melzer (2011) as a procedure whose result is subsequently reviewable and thus controllable. According to Popper (1997), it is not necessary for a scientific system to be singled out in a positive sense; however, it is necessary that its logical form shall be such that it can be singled out by means of empirical tests in a negative sense. It is necessary for an empirical scientific system to be refuted by experience.

9 Research limitations

Melzer (2011) further argues that in the case of normative sciences, refutation of experience is not an option; however, refutability of a specific result is one of the evidence of the scientific nature of this result. Therefore, a rational *legal methodology guarantees the predictability of judicial decision-making*, which is one of the primary prerequisites of the *rule of law*.

Therefore, when dealing with the scientific methodology of expert evidence, it is necessary to proceed primarily from the ENFSI Guideline for Evaluative Reporting in Forensic Science. The standards included in the Guidelines presuppose that the preparation of an evaluation report (as mentioned above, in terms of the polygraph examination, it is the so-called Report on the Performance and the Result of Polygraph Examination (Result of Polygraph Examination; Dohnalová and Štěpánková, 2019; Štěpánková et al., 2008), in any expert examination that has the nature of comparison (i.e., also in the case of a polygraph examination that analyses the difference between a true statement and an atypical response, false-insincere response, activation manifestations and others (Štěpánková et al., 2008) within the physiological responses of the person being examined), i.e., the expression of the degree of

agreement/difference. The court, when evaluating the conclusions of forensic examination, uses probability as a measure of uncertainty, which means that the essence of the matter is perfectly expressed here. The norm directly specifies that every statement made by the expert to the court, and which bears a certain degree of uncertainty must be accompanied by the expression of the degree of such uncertainty – *the only plausible measure of uncertainty is probability, which, however, is not used in the Report on the Performance and the Result of Polygraph Examination within the methodology of this examination.*

Therefore, it follows from the above that:

Polygraph examination as evidence within expert evidence, although fulfilling *the elementary purpose of § 89 (2) of the Code of Criminal Procedure – also set out in the explanatory memorandum (“the list of evidence specified in § 89 (2) is not exhaustive and thus other types of evidence can be used“)*, cannot be used as direct evidence.

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PREDICTION-BASED INVESTMENT STRATEGIES IN EUROPEAN BOND MARKETS

^aMATÚŠ PADYŠÁK

Comenius University Bratislava, Faculty of Mathematics, Physics and Informatics, Mlynská dolina, Bratislava, Slovakia
email: "matus.padyzak@fmph.uniba.sk

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Abstract: Daily returns of the European corporate bond market are predicted using a penalized Lasso regression or Random forests. Predictions are utilized in investment strategies that allocate resources into risky position: interest-rate hedged corporate bonds or unhedged corporate bonds and risk-free position proxied by the Euro-Bobl futures that track the German government bonds. The strategies are more profitable with a lower risk than their passive alternatives, which only invest in corporate bonds (hedged or unhedged), but the daily rebalancing can be costly. Therefore, we examine the break-even transaction costs and suggest two approaches to lower the overall costs. Overall, even with costs, active strategies based on prediction can achieve higher returns with a lower risk.

Keywords: corporate bonds, credit spread, machine learning, asset allocation, investing strategy.

1 Introduction

Prices of both government and corporate bonds are determined by corresponding cash flows and time to maturity, but both reflect the probability of default. On average, corporate bonds have a higher probability of default than government bonds that are often regarded as risk-free investments (at least for the most developed economies in the world, such as Germany or the US). Naturally, investors require a higher return for bearing the risk of investing in corporate bonds, and the difference is usually considered to be the spread between safer government bonds and their riskier peers. In other words, the yield of every bond could be decomposed into the risk-free part (government yield) and credit spread (CS) as compensation for a higher risk.

Although the returns of corporate bonds are expected to be higher, bond prices are constantly changing based on the demand and supply in financial markets. For example, high demand for safe assets or risk-aversion in the markets can easily cause a sharp increase in government bond prices and a sharp fall in riskier corporate bonds simultaneously. On the other hand, the risk-on appetite can push the riskier bonds up. Therefore, market-to-market bond prices constantly fluctuate based on the market's situation, and selling the bond before maturity can cause significant gains or losses.

The credit spread fluctuations and stressed periods open the question of whether it is possible to make predictions and a rule-based decision if investing in corporate or government bonds is preferable. Despite the ever-developing topic, the problem of risky or risk-free asset allocation is well documented in the literature. Still, the researchers are most interested in the equity market as a risky investment or the asset class allocation problem. A novel trend is to incorporate as much information as possible using machine learning methods that, compared to simple linear regression, have several benefits, such as variable selection, robustness, overfit, or the ability to describe non-linear patterns. The algorithms include Random Forests (Benhamou et al., 2020), neural networks (Babiarz and Barunik, 2021), or several methods at the same time, such as Wolff and Echterling (2020) who compared the PCA and regularized regressions: Ridge, Lasso, and Elastic net, Random Forests, Boosting, DNN and LSTM neural networks for a prediction which 50 stocks will outperform S&P 500 or STOXX Europe 600 indexes.

Although ML techniques are increasingly adopted to predict risky assets, the bond market is marginal. We aim to fill the gap in the literature by studying to which extent the European bond market can be predicted. Our research is closely related to Amenc et al. (2003), who studied the US bond market and predicted the monthly return using linear regression with pre-chosen economically meaningful variables, according to the authors.

The European corporate bond market is proxied by the widely followed Bloomberg Euro Corporate Bond Index that is easily investable through ETFs. The government bonds are proxied by Euro-Bobl futures based on a basket of medium-term (4.5-5.5 years) debt issued by the German government. The choice of the investment universe ensures that both assets are investable and liquid with efficient trading costs. Furthermore, the usage of futures allows taking a short position in treasury bonds, thus a possibility to hedge the interest rate. The hedged position offers a way to harvest the credit spread with a lower duration risk.

Regarding predictors, we study a large set of fundamental and technical variables and let the statistical methods select the variables. The motivation is to utilize interpretable ML techniques and perform a thorough explanatory analysis of variable importance. Additionally, there is potential to obtain a better prediction by unbiasedly choosing numerous variables suggested in the literature (even among other asset classes).

We examine the possibility of predicting the daily return of either the corporate bond index or the interest-rate hedged corporate bond index (credit spread). Predictions are based on fundamental and technical data such as implied volatilities, yield curve properties, moving averages, and several statistical attributes of the market without a look-ahead bias. The methods include Lasso regression and Random forests since both methods provide insight into the importance of the variables used for predictions. Subsequently, both approaches are utilized in an investment strategy that allocates into riskier (un)hedged corporate bonds or safer government bonds, considering the predicted return. A thorough analysis of transaction costs further examines the practical feasibility. Several approaches are offered, such as rebalancing if the predicted return is higher than anticipated costs or less frequent weekly rebalancing.

2 Data

The corporate bond market is proxied by the Bloomberg Euro Corporate Bond Index with an average maturity of approximately five years. The index is easily investable in the market, e.g., by buying iShares Core €Corp Bond UCITS ETF. The government bond universe is tracked by the Euro-Bobl futures, which have a basket of medium-term 4.5-5.5 years bonds issued by the German government as the underlying asset. The data spans from 6.4.2009 to 25.1.2021. The interest rate hedged corporate bonds are proxied by a long position in the corporate index and an equal short position in the futures. Therefore, the hedged investment is equivalent to the long position in credit spread that is defined as the difference between daily realized return of corporate bonds and German government bonds:

$$\text{creditspread}_{j,t} = r_{corp,j,t} - r_{futures,j,t}. \quad (1)$$

The variables used for predictions include implied volatility indexes VDAX (DAX index) and VIX (S&P 500 index), commonly referred to as the fear index calculated from options. Although VIX is linked to the US stock market, it can be an excellent global proxy in the era of globalization, while the VDAX is linked to the German stock market with a premier position in the Eurozone. Although volatility indexes are indicators of the investor's expectations regarding the volatility of main equity indexes, corporate bonds and equities are linked since both represent claims to assets of the firm (Merton, 1974). As another uncertainty measure, we employ the Merrill Lynch Option Volatility Estimate (MOVE) index, which is related to the implied volatility of US treasuries with a maturity of 2, 5, 10, and 30 years. Unfortunately, the comparable European index is not timely published, but the methodology was presented and constructed for past data (Baran and Voříšek, 2020). For volatility indexes, we evaluate the absolute values and daily changes (from t to $t-1$). For the VIX and VDAX, we also evaluate the intensity of change defined as the daily change scaled by the value of the index at day t . The data include open

prices at day t to predict price change at day $t+1$ (from market close at t to market close at $t+1$) to avoid look-ahead bias.

Secondly, we include information from the foreign exchange market - the EUR/USD spot rate, as the dollar is the world's reserve currency and is considered a safe haven. Euro is also regarded as the safe haven, and the hedging properties of EUR or USD also depend on the investor's country. USD is a better hedge for Asia and Latin America, while Euro is a better hedge for emerging European countries (Beck and Rabhari, 2008). The variables include the change over the previous 1, 5, 10, and 20 days and the last known spot rate for the model is from the previous day's open.

One of the key concepts in quantitative investing is the trend following or momentum, e.g., in asset class picking (Faber, 2013), S&P 500 investing (Beaudan and He, 2019), or corporate bonds predictions (Kaufmann et al., 2021) and Guo et al. (2021). Therefore, we include the past credit spread moving averages of 5, 10, 15, and 20 days with a two-day lag as the data is sampled at the market's close.

The variables also include the three months EURIBOR as short-term rates are one of the key policy instruments of central banks (Diebold et al., 2005) and proxy for expected inflation (Fama, 1975). The short rates are expected to influence the long-term rates since the bond yield consists of the actual rate, expected rate, and term premium (Brooks, 2021). Furthermore, the three-month risk-free rate changes affect credit spreads (Astrid Van Landschoot, 2004). While the short rate is often the starting point of a yield curve, other components such as level (three-month rate) and slope (the difference between the 10-year yield and 3-months rate) were also found to be significant (Astrid Van Landschoot, 2004). More traditionally, the yield curve level is defined as the yield of the longer maturity 10-year bond and the slope as the difference between the 10-year yield and 3-months rate (Diebold and Li, 2006). Therefore, the variables include the level and slope of the German yield curve based on the previous day's open prices and the daily changes of both level and slope.

Lastly, we include several statistical characteristics such as standard deviation (volatility) and skewness. Credit spread volatility is an indicator of return dispersion. It can signal a higher expected return according to a classical economic theory where an investor should be compensated for increased risk (Sharpe, 1964). On the other hand, cross-sectionally, low-volatility assets outperform high-volatility assets (Blitz and Vliet, 2007). The predictors include the volatility of credit spread based on the past 10, 15, and 20 days with a lag of two days to avoid the look-ahead bias. We also estimate the volatility of indexes VIX and VDAX since the past realized volatility of volatility expectations (implied volatility) can indicate periods with a high dispersion of market expectations. The volatility is estimated on the past 10, 15, and 20 days based on open prices. From the statistical characteristics, we also employ the realized skewness since it was found to be a reliable predictor across several asset classes such as individual stocks (Amaya et al., 2015), equity indexes (Zaremba and Nowak, 2015) or commodities (Fernandez-Perez et al., 2018). According to the theory, assets with large skewness have fat tails and a small probability of high returns, which investors behaviorally perceive as attractive. Subsequently, these assets are overpriced with low expected returns. The skewness is estimated for corporate bonds, government bonds, and credit spread individually, based on the past 20 days with a two-day lag.

Empirically, the fluctuations can be observed by plotting the moving average of the return difference between corporate and government bonds, where the returns are directly computed from bond prices. We expect that in crises, the riskier bonds will underperform their safer government alternative as the result of higher demand for safe-haven assets and risk-off sentiment. Therefore, in Figure 1, we plot the moving average with highlighted crisis periods defined as periods of heightened implied volatility in the European bond market (Baran and Voříšek, 2020) and the corona crisis. The periods include default fears, several key ECB announcements, Brexit, and other

political crises. For a fundamental reasoning behind these crises, we refer to Baran and Voříšek.

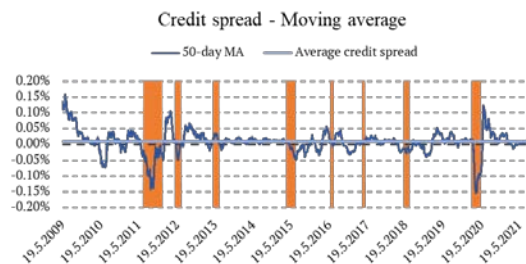


Figure 1: Credit spread development. The sample period spans from 19.5.2009 to 21.10.2021. Crises are highlighted.

On the one hand, the credit spread is positive, and corporate bond investors are compensated for their higher risk in the long run. On the other hand, there are several periods where corporate bonds significantly underperform, and many coincide with crises. Moreover, periods of credit spread underperformance occur when the interest-rate hedged corporate bond position suffers. Notably, the periods with risk-off sentiment where corporate bonds decline with an immense interest in safe havens create a scenario where credit-spread harvesting is mainly unprofitable. The reason is that hedging is getting more expensive and is not compensated by higher corporate bond returns.

3 Predictions and application

3.1 Prediction

Based on both fundamental and technical variables outlined in the previous section, we aim to predict the next day's credit spread or corporate bond return. The problem can be defined as follows:

$$\hat{r}_{t+1} = f(\theta, x). \quad (2)$$

The function f and parameters are model-dependent, and x are explanatory variables that are known at time t or sooner. Each explanatory variable is rescaled by min-max normalization.

Regarding the methods used, we utilize the Lasso regularized regression, which can shrink coefficients, has a variable selection property and should be more robust. Regression is estimated in R using the package "glmnet," and the optimal lambda parameter of the Lasso is found by cross-validation (Friedman et al., 2010). Random forests are used as a second method for comparison since this method is non-linear and alleviate the problems with single trees that tend to be overfitted. Random forest trains several trees where each tree can have a distinct training dataset, and the result is aggregated across the trees. For Random forests hyperparameters we set the number of trees to 500 and explore several variants of variables randomly sampled as candidates at each split: 12, 18, and 24. Trees are trained in R using the "randomForest" package (Liaw and Wiener, 2002).

The training dataset is expanding, i.e., we first train the model based on the first 200 days of the sample, and the following 20 days are used for the out-of-sample test. Then we add these 20 days to the training set, train the models based on 220 days, and leave the subsequent 20 days for the out-of-sample test. We iteratively continue until the end of the sample.

From a statistical perspective, we evaluate the mean squared error, accuracy, and weighted accuracy. Let n be the number of predictions, \hat{y} the predicted return, and y_i the real market return. We define the accuracy based on the correct sign of prediction so that the prediction is accurate when credit spread (corporate bonds return) is positive (negative) if the realized return is positive (negative):

$$\text{Acc} = \frac{1}{n} \sum_{i=1}^n 1_{\text{sign}(\hat{y}_i) = \text{sign}(y_i)} \quad (3)$$

The weighted accuracy is weighted by the magnitude of the return since, from the economic point of view, it is more vital to predict larger returns (losses) correctly:

$$\text{Acc}_w = \frac{1}{\|y\|_1} \sum_{i=1}^n 1_{\text{sign}(\hat{y}_i) = \text{sign}(y_i)} \times |y_i| \quad (4)$$

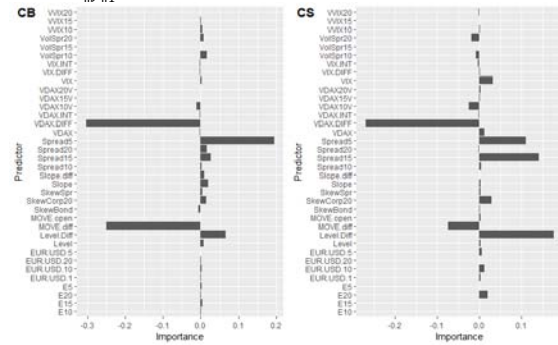


Figure 2: Most essential predictors for corporate bonds (CB) and credit spread (CS).

The methods can also reveal which variables are most important for the predictions. Hence, we can examine which variables mostly affect the expected performance of either corporate bonds or credit spreads. Since all variables are standardized, for Lasso regression, the importance of the variable is defined as the average coefficient from the regression over all training sets divided by the sum of the absolute values of all coefficients. Such a definition informs us not only about the magnitude of influence in the prediction (absolute value of importance measure) but also if the predictor's value is negative or positive, e.g., if the importance is negative (positive). It means that the higher values predict a smaller (higher) subsequent performance. We only plot results for Lasso regression, but the results for Random forests can be obtained using the "randomForest" package (Liaw and Wiener, 2002) in R and are qualitatively comparable.

According to Figure 2, the essential variable for the prediction of both corporate bonds and credit spread is the daily change of VDAX, which affect the subsequent returns negatively, whereas the absolute value of the index or the intensity has only a minor prediction ability. Another critical variable is the MOVE index's daily change (difference), but it is more significant for corporate bonds than credit spread. The importance is reversed for the difference in the yield curve level, which is a major variable for credit spread but has a lesser importance for corporate bonds. Since the credit spread has an embedded short position in government bonds, it is in line with economic intuition that the yield curve-related variable is an important predictor. For both types of prediction, the past spreads also significantly influence the expected performance, and the model indicates a return continuation (momentum) since the sign is positive. Although the importance of other variables is minor, their cumulative contribution is not negligible.

As shown in Table 1, the statistical accuracy is comparable across both methods for credit spread and corporate bond predictions. Furthermore, the accuracy is more significant than 50%, an essential benchmark since the performance is better than the random decision of whether the market would go up or down. The promising statistical accuracy of the predictions, and the fact that the weighted accuracy is, in fact, higher than the naive one, raise a question if it is possible to employ the aforementioned predictions in financial practice.

Panel A: Credit spread				
	Lasso	RF(500,12)	RF(500,18)	RF(500,24)
Acc	0,595	0,584	0,585	0,579
Acc _w	0,62	0,602	0,615	0,605
MSE	1,511×10 ⁻⁶	1,849×10 ⁻⁶	1,908×10 ⁻⁶	1,872×10 ⁻⁶
Panel B: Corporate bonds				
	Lasso	RF(500,12)	RF(500,18)	RF(500,24)
Acc	0,587	0,576	0,582	0,58
Acc _w	0,638	0,632	0,634	0,637
MSE	2,442×10 ⁻⁶	2,796×10 ⁻⁶	2,859×10 ⁻⁶	2,83×10 ⁻⁶

Table 1: Statistical accuracy of predictions.

3.2 Market timing strategies

Based on the accuracy of the predictions, we propose a straightforward trading rule: if the predicted return of corporate bonds (credit-spread) is positive, invest in corporate bonds (credit-spread), and if the predicted return is negative, invest in government bonds. The proposed market-timing strategy aims to allocate risky assets (corporate bonds, either hedged or not) or safe assets proxied by government bonds. However, such a trading rule needs more practical feasibility since the strategy can rebalance itself daily, which could cause substantial trading costs. Still, the majority of research is mainly focused on the theoretical world – without any transaction costs or the need to employ some lag in the decision process. Nevertheless, some literature considers the feasibility and transaction costs, e.g., break-even costs when the strategy is still profitable and sufficient lag in the data (Blitz et al., 2022). Therefore, we study the break-even transaction costs when the strategy is still profitable compared to the alternatives – passively hedged corporate bonds or corporate bonds. Next, we suggest two approaches to lower the overall transaction costs. In all scenarios, we examine five levels of transaction costs from 1 basis point to 5 basis points (bp). For the first approach, the strategies can be rebalanced less frequently, e.g., every five trading days (weekly). Secondly, we suggest a tactical approach where the strategies are rebalanced only if the predicted return is higher than the expected transaction costs. Therefore, the strategy switches if the predicted return is 3bp and the costs are assumed to be 2bp. However, if the predicted return is -1bp and the costs are assumed to be 2bp, the strategy does not rebalance.

For credit spread predictions, the market timing strategy becomes unprofitable if the transaction costs are 5bp and is less profitable than passively interest-rate hedged corporate bonds if costs are 4bp. On the other hand, if costs are 3bp or lower, the prediction-based strategy is more profitable even without any approach to mitigate the effect of costs. Based on Figure 3, both approaches that aim to lower overall transaction costs can do so successfully, but the tactical approach relates to a lower risk than less frequent rebalancing. The effect of transaction costs for corporate bond strategies is similar. According to Figure 4, all tactical approaches are better than their passive alternative, which also holds for the majority of less frequently rebalanced strategies. Moreover, the predicted strategies are significantly less risky than a passive investment in corporate bonds.

The attractive property of prediction-based strategies is their ability to decrease risk, which is the result of successfully switching between riskier and safer investments. For example, for credit spread timing strategies, the risk measured by volatility is similar to the passive credit spread investing, but the maximal drawdown is much lower (Figure 3). The lower risk is even more evident among corporate bonds, where both volatility and maximal drawdown are lower (Figure 4). For both investment universes, the lower drawdowns and more stable returns can be observed by inspecting Figure 5, which shows the simulated performance of investment portfolios based on the market timing strategies.

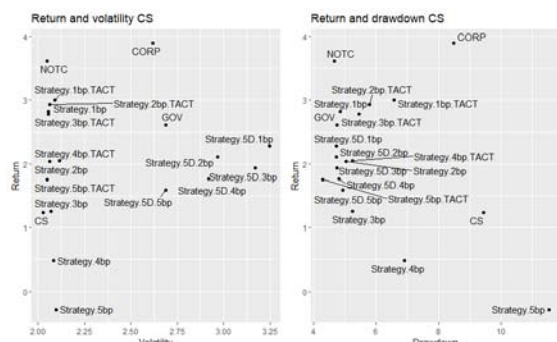


Figure 3: Return, volatility, and maximal drawdown of credit spread strategies based on Lasso predictions. CORP stands for corporate bonds, CS stands for credit spread, government bonds are denoted as GOV, theoretical strategy without transaction costs as NOTC, strategies with a tactical approach to rebalancing as TACT, and strategies with weekly rebalancing as 5D. Returns and volatilities are annualized in percentage points. Maximal drawdown is denoted as a positive number in percentage points. Results for random forests are available but unpublished and qualitatively comparable.

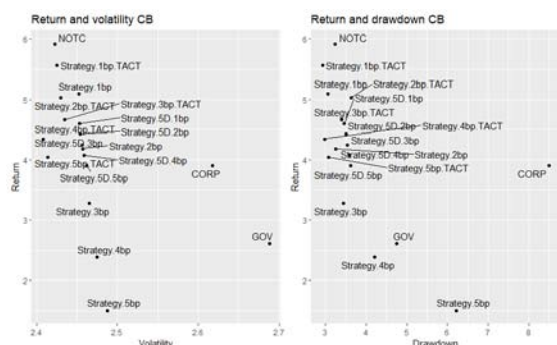


Figure 4: Return, volatility, and maximal drawdown of corporate bond strategies based on random forests (500,12) predictions. CORP stands for corporate bonds, CS stands for credit spread, government bonds are denoted as GOV, theoretical strategy without transaction costs as NOTC, strategies with a tactical approach to rebalancing as TACT, and strategies with weekly rebalancing as 5D. Returns and volatilities are annualized in percentage points. Maximal drawdown is denoted as a positive number in percentage points. Results for Lasso are available but unpublished and qualitatively comparable.

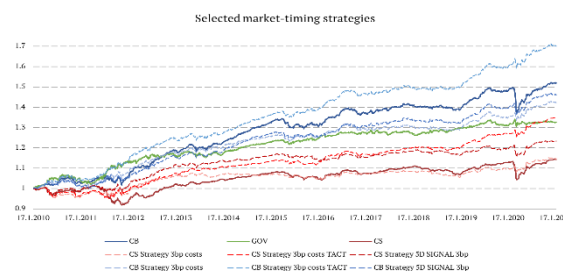


Figure 5: Performance development of selected prediction-based market-timing strategies.

4 Conclusion

On average, corporate bond returns are higher than government bonds. However, the outperformance does not remain constant. There are periods when corporate bonds are less profitable than government ones, coinciding with periods when credit-spread investing has been unprofitable. We have shown that both the corporate bond market and credit spread (interest-rate hedged corporate bonds) have been predictable to the extent that it has been possible to include the predictions in asset allocation decisions. We have obtained accurate predictions of the next

day's return using either Lasso regression or random forests based on several fundamental and technical variables without look-ahead bias. The choice of the methods has allowed us to examine the most critical variables, which include the daily change in the DAX implied volatility, change in the level of the yield curve, changes in the implied volatility of the US bond market, and moving averages of past credit spreads.

The predictions could have been used in practice by constructing trading strategies that have invested in risky (credit spread or corporate bonds) and safe assets (government bonds) based on the predicted return. Furthermore, we have evaluated the effect of transaction costs and suggested two approaches to minimize the costs: less frequent rebalancing and a tactical approach where the strategies have only rebalanced if the predicted return has been greater than the anticipated costs. Firstly, we have identified the level of transaction costs that has eroded the performance to the extent of making it less profitable than a passive investment in corporate bonds or credit spreads. Secondly, we have shown that the less-frequent rebalancing and the tactical approach have significantly lowered transaction costs and maximized the strategy's returns. Overall, the tactical approach has been superior since, for both credit-spread and corporate bond strategies, even the 5bp costs would not have made the strategy less profitable than passive investment into credit-spread or corporate bonds.

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VIRTUAL REALITY AS A NEW PARADIGM OF TECHNICAL EDUCATION

^aPAVEL PECINA, ^bJONAS ANDRIŠIUNAS

^aMasaryk University, Faculty of Education, Poříčí 7, 60300 Brno, Czech Republic

^bVilnius Gediminas Technical University, Faculty of Mechanics, Plytinės g. 25, LT-10105 Vilnius, Lithuania
email: ^appecina@ped.muni.cz, ^bJonas.Andriusiuonas@gmail.com

Abstract: In the last ten years, means of a digital technology have been intensively penetrating in an education. Education is gradually moving into online space as 3D technology, virtual and augmented reality, and other digital technologies and digital tools have been developing. This trend is also referred to as connectivism in education by contemporary information sources. In technical vocational education and training (TVET), the trend is not sufficiently researched and elaborated so far. Thus, our theoretical study is aimed to analyse the current state of knowledge related to virtual reality and to define the main areas of virtual reality that can be used in the condition of TVET. In the first part, we have focused on the evaluation of previous studies devoted to technology development, especially virtual reality useable in education. In other parts, we have then focused on the possibilities of using specific elements of virtual reality in condition of TVET, together with the development of necessary competencies of TVET teachers through further education.

Keywords: virtual reality in education; virtual reality and artificial intelligence relationship in education; virtual education program in technical education

1 Introduction

There has been an intensive penetration of electronic education into all educational areas in the last ten years. With the development of multimedia technology and virtual reality tools, these tools are becoming more accessible and penetrating the various fields of education. Thus, teaching and learning increasingly take place in the online space and become a subject of interest for further (professional) education and lifelong learning as well. This fact is pointed out by many Czech and foreign authors who focus on research in the field of using virtual reality in education, the Internet of Things (IoT) and interactive teaching aids and software (Adamec & Šimáně, 2021a; Bajtoš, 2022; Ha & Fang, 2013; Turek, 2014; Svoboda et al., 2020; Utami et al., 2018; and others).

Development of human society is accompanied by an effort to increase production possibilities, through which the needs of consumers are satisfied. Since the resources to produce scarce goods, which are mostly used to satisfy these needs, are limited, it forces producers to look for ways to increase productivity and efficiency. Thus, manufacturers are looking for ways to achieve this increase in production through technology. Constant pressure leads to technological innovation, introduced directly into production, which manifests itself through industrial revolutions (Marinič, 2022; Marinič & Pecina, 2021). The individual waves of the industrial revolution affect not only the production itself, but also create pressures on increasing the qualifications and retraining of workers in production, as well as pupils in vocational education (Pecina & Sládek, 2017). The conditions on the market, created due to the influence of technological innovations, in connection with the adequate quality of vocational education, can thus create a suitable environment for the application of young as entrepreneurs and contribute to the solution of the problem of the transition of young people to the labor market (Marinič & Zathurecký, 2016).

The last wave of the industrial revolutions is already a human-driven revolution, labeled Industry 4.0., which has brought the emergence of cyber-physical systems leading to communication between machines and men, machines to each other, the connection of the virtual world with the real world, and the emergence of so-called smart factories. In them, goods and products are created in virtual reality and then transferred to the real environment where they are manufactured. In smart factories, fully automated production takes place using robots and automata (National INDUSTRY 4.0 initiative). The Internet of Things (IoT) and the Internet of Everything (IoE) play an important role here. Virtual reality is gradually expanding into the field of education and is gaining an important role in this field (Lacina et al., 2015).

The aim of the presented theoretical study is to define virtual reality in the conditions of education and to evaluate the benefits and reserves of the use of virtual reality in the conditions of technical vocational education and training (TVET). Another goal of the study is to identify software in the field of virtual reality directly designed, or at least usable, for educational purposes and to demonstrate on chosen examples the use of such software.

2 Digital technology development and virtual reality

From the broader context, virtual reality belongs to the framework of electronic education and connectivism in education (Vaněček et al., 2016; Zounek et al., 2021). Connectivism represents the creation, sharing and editing of information that is created in the digital environment. As Zounek et al. (2021) points out, much information today is created in the digital environment and a large part of learning takes place in this space (see also Lorenzová & Svoboda, 2020). The same authors state that connectivism is a new paradigm of education. Connectivism is a contemporary educational theory that focuses on people's learning in the digital age. According to connectivism, learning is the process of creating and maintaining connections between different groups of people, sharing ideas and sources of information and technology. Connectivism emphasizes the great importance of networks and digital technologies in the whole learning process. Another dominant feature is the fact that learning today is not limited to formal educational institutions and areas. It is quite common for people to learn in informal and unplanned situations such as social networks, discussion forums and other online community platforms. As Gartner (2009) points out, the virtual space was created based on the connection of simulations, computer games and social networks. This created the so-called multi-usable virtual environment, which spread in science, entertainment, and education.

Virtual reality (VR) represents an interactive three-dimensional environment that is based on real foundations or created completely artificially. Lochmann (2020) specifies that we have two categories of virtual reality – projection virtual reality and desktop virtual reality:

- *Projection virtual reality* presents three-dimensional virtual models that are projected into the space of the room and can be viewed from different perspectives.
- *Desktop virtual reality* is shown on a computer screen using special glasses.

The main task of virtual reality as a created environment is to bring the environment to the reality as perceived by human senses. Currently, virtual reality is widely used in various areas, such as research and development workplaces, the entertainment industry or education. There are apps and software for virtual education in healthcare, architecture, military, construction, engineering, or gastronomy (Pecina & Adamec, 2022). In the mentioned broader concept, virtual reality in education includes the following tools and resources that form part of use of virtual reality in the educational environment:

- *Interactive aids* that use dynamic image, sound, and animation elements such as subtitles, labels, etc. (e.g., educational animations, simulations, etc.).
- The use of *3D technology and 4D technology* in education with the use of special glasses and other means with which people are transferred to virtual reality.
- *Means of augmented reality*, when existing elements and objects are combined with new – augmented – reality (e.g., virtually created object placed in the existing environment, virtual elements in map materials that are projected in means of transport, such as projection on the glass of a vehicle, etc.).
- *Virtual learning tools* (e.g., Virtual Bricklayer, Virtual Car Mechanic, Cooking Simulator, Surgery Simulator).

As can be seen, virtual reality represents a very diverse and relatively new dimension of educational reality, which uses all visualization elements that involve all the senses (sight, hearing, touch, movement, feel, smell, and taste). Virtual reality and other means of information technology have brought so-called media visualization (use of illustrative examples through media) into education, which is another and advanced level of visibility or use of illustrative examples (Vaněček, 2008; Vaněček, 2011). Today, these systems commonly use headsets that allow people to view and move around in a completely virtual world. There are also devices that allow tactile (haptic) response.

The possibilities of using virtual reality in education are appropriately summarized by Lorenzová (2020, pp. 140-142), who states that virtual reality can be used through virtual simulations, virtual games, experiential learning in virtual places, virtual schoolrooms and virtual classrooms, virtual and remote laboratories, virtual assistants for teaching, and wide spectrum of 3D models and 3D modeling in teaching. In this context, the connection between virtual reality, augmented reality, mixed reality, and artificial intelligence should be pointed out (Johnson et al., 2016). As Lorenzová (2020) points out, virtual reality, augmented reality, and personal assistants, in a form of Chatbots using artificial intelligence in teaching, are combined in virtual classes.

In the conditions of the Czech Republic, there are entire educational fields of study which are realized online and with the use of virtual reality. Appropriate example is the educational field of "Design of information services" at the Faculty of Arts at Masaryk University in Brno. In the following picture (Figure 1) we can see a recording of virtual reality environment testing of the mentioned educational field of study.



Figure 1: Educational program in virtual reality
(Source: <https://kisk.phil.muni.cz/profilace/design-informacnich-sluzeb>)

The study program in mentioned educational field of study uses virtual classes and didactic games in an online environment. Students can join classes from anywhere in the world. Synchronous online teaching is carried out during teaching hours every Friday. Personal meetings are optional. Thus, the virtual reality environment allows students to study in various ways in the environment such as frontal teaching, group activities with peer learning or collaborative teaching but also provides possibilities for individual meeting with students and between the students as a part of socialization.

3 The advantages and reserves of virtual reality in education

Virtual reality finds its application in educational reality and therefore advantages and reserves of virtual reality in education can also be identified. In the Czech Republic, the advantages of teaching and training using virtual reality have been pointed out

by the Occupational Safety Research Institute [Výzkumný ústav bezpečnosti práce], which points to the activation of participants' training quite naturally in a safe environment and very realistically (VUP, 2021). Among other advantages inexpensive operation and maximum visualization of teaching through illustrative examples can be mentioned.

The main advantages of using virtual reality in education can therefore be summarized through the following arguments in the individual assessed areas:

- *Safety.* There is no danger of an occupational accident in virtual reality. Dangerous and risky actions and activities can be tried without endangering the health and life of participants and their colleagues. There are also no financial risks associated with damage to expensive equipment and tools in case of inappropriate handling during the teaching and learning process.
- *Maximum visualization of teaching and learning.* All senses can be engaged in virtual reality stimulating the learning process. Things and events can be shown literally from every possible point of view and in different situations and settings.
- *Measurable progress in education.* Virtual reality enables more effective acquisition of intellectual and psychomotor skills. It allows learning progress to be recorded in individual areas, providing invaluable feedback to the learners, and allowing them to adapt their pace and learning style to obtain new intellectual and psychomotor skills.
- *Use of gamification elements.* Due to their technical design, simulation and interactive software for virtual reality can be considered like computer games that use the advantages of didactic games in an electronic environment. Thus, virtual reality provides information and develops learning in a funny way, through funny activities in teaching, while stimulating the learning process.
- *Economical efficiency.* There is no need for expensive consumables or the purchase of expensive gadgets and accessories in virtual reality. It can be argued that interactive learning software for virtual reality are expensive in themselves. Although it is true, but once the educational institution acquires them, there is no need to purchase any additional accessories. Everything happens in virtual space. Virtual reality reduces the costs associated with potential damage of also expensive physical equipment, when virtual reality is not used, due to potential inappropriate handling during the educational process.

Like every technology and educational concept, virtual reality has also its reserves or disadvantages. The main disadvantage is the fact that it is the virtual reality, therefore, it is essentially separated from the actual reality, and even though almost all human senses can be engaged with it, it is still a simulation in a virtual environment. Some factors cannot be simulated without problems in virtual reality, e.g., the effect of tool wear on work, changing conditions at different temperatures, environmental influences, the effect of physical fatigue on the work performed, and many other factors encountered in the performance of work tasks in a real environment. In the event of an error, there are no injuries or material damage to the equipment. The simulation can be simply reset, and it is possible to continue working. This can lead to a loss of motivation and concentration, potentially leading to carelessness and recklessness, resulting from an exaggerated awareness of a safe environment, as opposed to the real conditions of performing the given actions in actual real environment.

The main reserves or disadvantages of using virtual reality in education can be summarized using the following arguments:

- *Virtual reality is in fact an illustrative preliminary stage of professional training* for the real performance of a given activity. It is still only a "faithful substitute for reality" for the purpose of more effective and economically efficient professional training for the performance of given expertise.
- *Virtual reality does not solve everything;* it is a simulation of activities and actions. The real world looks and can behave

differently. There are always situations and circumstances that cannot be simulated and pretended.

- *If virtual reality is not linked to artificial intelligence*, there will be no automatic evaluation of individual steps and actions of the learning subject nor any other form of active adaptation of the educational process to the learner based on the achieved educational progress. In that case, a trained expert (trainer or instructor; TVET teacher) must be available to do it.
- *The relatively high cost of equipment and the necessity of training the teaching staff.*

As can be seen from the above, teaching using virtual reality is associated with visualization through illustrative examples and safety of teaching, as well as with experience and connection with didactic games in an online environment. Didactic games in virtual reality are a suitable motivational element for involving pupils in teaching. Didactic games primarily interest pupils and they engage in pupils voluntarily. The secondary benefit of these activities is learning and fulfilling the set of learning objectives. In this context, we talk about the gamification of teaching. (Pecina, 2022).

4 The relationship between virtual reality and artificial intelligence in education

Human intelligence is defined as the general ability to solve problem and task situations. In addition, we currently have Gardner's theory of multiple intelligences, which states that each person has abilities and dispositions to excel in a specific area or more certain areas (Gardner, 2018). Artificial intelligence (AI) is defined as the entire field of informatics, which is focused on the development of systems that solve various tasks (calculations, classification, recognition, text processing, etc.). Another definition states that it is the ability of computer systems to mimic human cognitive functions, such as learning or problem solving. Artificial intelligence includes expert systems, chatbots, personal assistants and machine learning.

Virtual reality in the form of an educational software used for educational purposes in teaching and learning process may or may not be linked to artificial intelligence. If virtual reality is not linked to artificial intelligence, the learning subject does not receive feedback from the software. As we mentioned earlier, this activity must be done by the trainer. If the educational software in the form of virtual reality include connection with artificial intelligence, all actions are assessed and evaluated. In that case, there is no need the trainer is part of the activity. However, experts point out that in this case the artificial intelligence must learn everything during the education process, which is accompanied by greater costs for the development and implementation of such educational software for virtual reality.

So, in general, we recommend having interactive educational software in the form of virtual reality equipped with artificial intelligence for the educational purposes.

5 Research on the use of virtual reality in education

From the foreign authors who have dealt with virtual reality in education, a professor at Stanford University and the founder of the Virtual Human Interaction Lab, professor Bailenson can be mentioned. He specializes in research on human interaction with virtual environments (Bailenson, 2018). Other leading author is Eck (2018) who specializes in the development of educational games and simulators for teaching needs. The use of virtual reality in the teaching of chemistry is the area of interest of Young (2017) from the University of Connecticut. Dede (2005) from Harvard University focuses on the use of technology for education and learning in the digital age as well.

In terms of technical vocational education and training, foreign works by Vincenti et al., (2020), Dobre et al., (2020), Liderman et al., (2013) and Tiwari et al., (2019) focus on the area of the use of virtual reality in engineering education and training in production.

In the conditions of the Czech Republic, this area was mainly dealt by experts at technical universities. Informatics professor Jiří Štěpán focuses on research into human-computer interaction, virtual reality, and the use of these phenomena in education (Štěpán & Španěl, 2019). Another author is Jan Gajdoš, an expert in computer games and multimedia, who focuses on the development and use of game technologies and virtual reality in education and other areas (Gajdoš & Šimůnek, 2018). In the last place, we mention Radek Pelánek, who is a computer scientist and focuses on the use of artificial intelligence and virtual reality in education (Pelánek & Staš, 2017).

Further research into the use of virtual reality in technical vocational education and training is mainly focused on the use of interactive educational software. All areas of technical education have great potential for using virtual reality as the various authors point out (Vaněček, 2016, Dostál et al., 2017).

It is evident from the above that virtual reality in education is synthesized in a desirable way with didactic games in the conditions of electronic education. Didactic games are a popular motivational tool and a means of involving pupils in teaching. If the didactic game is provided in a three-dimensional environment, it is an ideal connection of virtual reality with motivational and activation processes in teaching and learning.

6 Virtual educational software in technical vocational education and training

Nowadays, education in virtual reality is most represented abroad, especially in the USA and Western Europe. However, we also have information about the use of virtual reality in teaching from Asia, e.g., in Singapore (Milko, 2017; Pozniak, 2021; Tan, 2017). Based on the available sources, it can be concluded that the area of virtual reality is the most developed area in education.

Currently, virtual teaching software are used in the practice of technical vocational education and training at secondary schools. Only the selected options of using the educational software for virtual reality will be presented due to the extensive scope of the topic. Among other things, the following virtual learning software is available on the market in the Czech Republic and abroad for the needs of teaching in technical vocational education and training:

- *Job Simulator* – a game focused on examples of work in various professions. It can be used at the beginning of vocational training in technical fields such as car mechanic, welder, CNC machine programmer. (Job simulator, 2016)
- *Simutech* – the system allows students to perform virtual simulations of electrical circuits, which enables them to understand electrical processes and concepts. (<https://simutechgroup.com/ansys-software/electronics/>)
- *Labster* – the system allows pupils to perform virtual laboratory experiments in biology, chemistry, and physics. Pupils can investigate and compare different processes and reactions in a safe and controlled environment. (<https://www.labster.com/>)
- *SolidProfessor* – the system allows students to learn to use various software for design and production in the field of CAD and CAM. (<https://www.solidprofessor.com/schools/>)
- *VR Welding* – the system is designed for teaching welding. Students can perform virtual welding operations and improve their skills in real time. (<https://www.arclabs.edu/virtual-welding/>)
- *Autodesk BIM 360, Bentley Systems* – systems provide tools for creating and managing virtual buildings and infrastructure. They enable students to learn practically in real projects. (<https://www.autodesk.com/bim-360/>)

The above-mentioned virtual reality systems can be used in teaching as part of the application of the teaching simulation method. We also present an example of a welding simulator from Fronius. The simulator may not be technically alike the tool or machine in actual reality, but the skills practiced must be the same. The welding simulator consists of a computer that is

integrated into the form of a welding source. Special software with drivers and controllers in the form of welding torches or electrode holders with sensors that detect the position and movements of these controllers are part of the computer as the welding simulator. Simulators usually focus on conventional arc welding technologies, which are the most used in welding practice today. There are also robotic welding simulators for the training needs of welding operators. The price of welding simulators is currently (2023) between €8000 and €12000.



Figure 2: Welding simulator by Fronius
(Source: <https://www.mmspektrum.com/clanek/virtualni-svarovani-simulatory-pro-vyuku>)

7 Preparation of future TVET teachers and further education of TVET teachers in specific technical subjects

It will be necessary to implement the issue of virtual reality to the didactic training of future TVET teachers as well as in the further education of TVET teachers in pedagogical practice regarding the importance and contribution of this area to the technical vocational education and training. As Adamec (2021) points out, the importance of continuing professional education for pedagogues continues to grow. It is quite clear that the area of connectivism and virtual reality belongs there.

Although, there is material base, teaching topics and research findings, so far, however, there are not enough didactic sources in the field of branch didactics that would focus on the practical and application area of this issue in the field of technical vocational education and training in secondary schools. However, the sources are still rather fragmented and at the level of magazine studies or manuals. There are relatively few research papers with a practical application part. In the conditions of the Czech Republic, there is not yet a monographic study or a corresponding teaching text that would systematically treat this topic. The prerequisite for the development of the competencies of TVET teachers in the use of virtual reality for educational purposes is then the preparation of further education courses for TVET teachers of technical subjects in pedagogical practice.

For the implementation of this issue in TVET teacher training and further education, the following areas should be focused on:

- Justification, learning objectives and educational content in the field of using virtual reality in the preparation of TVET teachers.
- The concept and technology of teaching in this area.
- Specific inclusion of this issue in teacher training programs (time, scope, continuity with other areas of teacher training).
- Evaluation of the knowledge of the target group in this area.

The didactics of technical vocational education and training and the teacher of the vocational specific subject are on the border between two fields – the didactics of technical vocational education and training and the technical field, focused on the technical side of preparing and implementing virtual reality. However, a teaching project using virtual reality is a team effort in which both teachers and IT professionals must participate.

8 Conclusion

The potential of using virtual reality in education is expanding very quickly. As can be seen, these areas bring maximum visualization through illustrative examples, strong experience, vividness, dynamism, and an easier way to understanding relatively complex phenomena, processes, and systems into the teaching. However, it is necessary to keep in mind the reserves and disadvantages of this phenomenon, which is mainly the fact that it is an artificially created environment that is not real and cannot imitate or demonstrate certain things. In further development, a wider implementation of virtual reality in the education of all fields, including technical ones, can be expected. The next generation of devices and equipment will provide a more perfect experience and wider possibilities. In this context, experts talk about spending more time in virtual worlds.

It will be necessary to revise the system of didactics of technical vocational education and training in relation to this phenomenon, because apparently a new paradigm of technical vocational education and training is emerging. In further work, we have the ambition to map the currently available interactive programs and simulators for the needs of technical vocational education and training and their use in technical vocational secondary school. The output could be a monographic study on the issue of virtual reality in technical vocational education and training.

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MACROECONOMIC FACTORS OF IPO IMPLEMENTATION IN THE CEE REGION

^aSYLVIA PLOTTOVÁ, ^bROMAN BRAUNER, ^cTOMÁŠ HERÁLECKÝ, ^dPETR ZIMČÍK

Newton University, Faculty of Economics, Rašínova 103/2 602 00 Brno, Czech Republic

email: ^asylvia.plottova@newton.university,

^broman.brauner@newton.university,

^ctomas.heralecky@newton.university,

^dpetr.zimcik@newton.university,

Abstract: This paper aims to identify macroeconomic factors that influence IPO implementation in selected Central and Eastern European capital markets. Survey-based research has been conducted within a sample of non-financial companies operating in the Czech Republic, Croatia, Hungary, Poland, and Romania. The results suggest that favorable macroeconomic conditions such as GDP growth, low interest rates or positive development of local capital markets promote companies' interest in IPO implementation.

Keywords: IPO, macroeconomic factors, going public, CEE region

1 Introduction

IPO or initial public offering (IPO) is the moment in a company's lifetime that requires considerable attention and can considerably change its further development. (Pagano et al., 1998; Ross et al., 1996; Meluzín and Zinecker, 2009; Loughran, T., JR Ritter, and K. Rydqvist. 1994). This article focuses on identifying macroeconomic factors which influence decisions on the company's implementation of IPO in Central and Eastern Europe. Compared to its Anglo-Saxon alternatives, most of the stock exchanges in CEE are significantly underdeveloped. Only the Warsaw stock exchange has witnessed a fair amount of IPO in past decades. A question arises if this is due to the lack of interest in going public in this region or when macroeconomic factors play a role. This research is focused on researching the primary data from CFOs of surveyed companies from the CEE region that implemented IPO between the years 2004-2016. There is a lack of evidence on macroeconomic factors influencing IPO implementation in the CEE region. In this research, the representatives of selected companies that implemented IPO in the CEE region were asked to address their opinions on the importance of macroeconomic factors on IPO implementation.

2 Theoretical Background

Current Central and Eastern European studies claim that raising capital is the most important reason for an IPO. (Meluzín, Zinecker and Lace, 2016). However, the timing of entering the capital markets remains less researched. There exist three main theoretical explanations for the IPO timing phenomenon. The first theory states that firms enter capital markets under favorable economic conditions that support their continuous growth and development (Loughran & Ritter, 1995; Ritter & Welch, 2002). Such conditions are, therefore, of external nature, and the issuing company cannot directly influence them. As a rule, they are shaped by the economic situation of the given country, legislative framework, maturity of the capital market, etc. The second theory says that companies enter capital markets when other companies also enter these markets (Choe, Masulis, and Nanda, 1993). De Albornoz and Pope (2004) found that the IPO is affected by the market valuation of companies in the same industry. That is when there is a positive development in the company's sector or directly related sectors. In cases where competing companies have implemented IPOs successfully, other comparable companies are likely to want to gain the same benefits as the issuing competition. The last theory explains that IPO timing is derived from the business life cycle theory. This theory is based on the idea that IPOs occur when issuers find themselves at a certain stage in the business life cycle where they need more capital for further growth (Choe, Masulis, and Nanda, 1993; Lowery, 2002). In connection with IPOs, there is also a theory that entry into capital markets indicates the quality of issuers. This theory is based on information asymmetry between

issuers and investors. The relationships between the number of IPOs and macroeconomic factors have been investigated, for example, by Loughran et al. (1994). Their study analyzed the timing of IPOs in 15 states in relation to inflation-adjusted stock price indexes and measures of gross domestic product. The study results indicate a positive relationship between the number of IPOs and the level of stock market prices. However, no positive correlation with the business cycle was found. Rees (1997) found in his research that the level of stock indices influences the number and volume of IPOs. The ability to issue shares at high prices is a possible explanation for motivating IPOs. The occurrence of IPOs is positively associated with the level of the stock market. Rees (2002) reports that stock index developments predict both the value and the number of IPOs. Rydqvist and Hogholm (1995) compared data on a sample of family businesses in Sweden and eleven European countries between 1970 and 1989. They found that most IPO activity occurred after a sharp increase in stock prices. Breinlinger and Glogova (2002) investigated the predictive power of selected macroeconomic factors affecting IPOs by analyzing a sample of the annual volume of IPOs in six developed European countries over 18 years. The authors aimed to answer whether there are consistent indications that IPOs follow stock index returns. The results showed that the logarithmic transformation of IPO volumes leads to constant regression estimates for individual countries and the entire sample. Empirical evidence has not supported the hypothesis that the percentage change in savings, gross domestic product growth, and interest rates is predictive of IPO volumes. In his study, Ameer (2012) presents a negative relationship between interest rate and the number of IPOs and a significant positive relationship between industrial production and the number of IPOs in the emerging market of Malaysia. However, Kovandová and Zinecker (2015) found out that the reference interest rate had explanatory power for IPO numbers in the Polish capital market between years 1993 to 2012. Bilson et al. (2002) find only modest signs of a link between local macroeconomic factors and returns in emerging capital markets. Determining characteristics of capital markets that influence the decisions of companies to issue securities in the developing capital markets of Central and Eastern Europe were subjected to empirical investigation by Roženský (2008), Peterle (2013), and Brzeszczyński (2014). They focused on the attractiveness of primary capital markets in Central and Eastern Europe and used quantitative and qualitative indicators for them. Quantitative factors such as capital market size, capital market liquidity, and stock index returns were monitored. Peterle (2013), who examined IPOs in the Central and Eastern European region between 2000 and 2009, found that capital market factors such as market size, liquidity, and capitalization to gross domestic product do not have a determining effect on IPOs in the Central and Eastern European region. Eastern Europe. However, it is possible that the attractiveness of the capital markets measured by the annual profitability index and the annual growth of the market and their liquidity could have been stimuli for the growth of the number of IPOs in the monitored period. Brzeszczyński (2014) explains that the development of the capital market strongly influences the decision of Polish companies to issue securities on the capital markets and that the number of IPOs increases with rising prices and decreases with falling prices. The effects of past periods and institutional influences were assessed by indicators such as 27 companies' perception of the capital market, their trust in capital markets, and the quality of state supervision and related regulations. Roženský (2008) examined the conditions created by local stock exchanges using indicators of IPO costs, administrative requirements for issuers, the market division of a given stock exchange, and their marketing and public relations activities. Groh et al. (2010) concluded that investor protection, corporate governance rules, capital market size, and liquidity are determinants of financial community expertise, trade flows, and exit opportunities.

The Central and Eastern European stock exchanges are developing differently than the capital markets of Western Europe. Differences can be found mainly in the state's development, primarily the existence of communism in the CEE region, different legislation frameworks, and socio-cultural aspects. All the researched companies from this study are located in former soviet countries in the Czech Republic, Slovakia, Hungary, Croatia, Bulgaria, Romania, and Poland. Since 2004 most of them have belonged to the European Union and have harmonized legislation frameworks regarding IPO. Nonetheless, the numbers and volumes of IPO vary. Poland witnessed the most considerable volume of IPO in the past 15 years. The least IPO was carried away in Slovakia. The same situation is in other selected countries where only a few IPO were implemented. (Meluzín, Zinecker, and Lapiňská, 2014; Brzeczynski, 2014; Peterle, 2013; Roženský 2008; Peterle & Berk, 2016).

3 Research Methodology and Data Collection

This article is based on the primary data collected from a sample of 33 companies that conducted IPOs on selected local stock exchanges in the CEE region. The data collection took place in 2019 and the beginning of 2020. Due to the lack of current knowledge of the influence of macroeconomic factors on the decision-making process in the IPO implementation, the data were collected by questionnaire. The researched sample was selected from companies that implemented IPO on CEE stock exchanges between 2004 and 2016. In these years, the EU legislation framework was harmonized, and foreign direct investors acknowledged the opportunities arising from investments in the Czech Republic, Poland, Hungary, Croatia, Bulgaria, and Romania. The questionnaires were sent to the CFOs of a selected sample of companies. These companies implemented IPO on the primary and secondary markets of the selected stock exchanges. In total, 150 respondents were selected for this research. The respondents were given the questionnaire, which included selected statements related to the IPO decision-making process and the influence of macroeconomic factors. A five-point Likert scale (1 minor importance to 5 significant importance) was used to allow the respondents to state their agreement or disagreement with the statements. The results of the survey were evaluated using the methods of descriptive statistics. In total, 33 completed questionnaires were collected. Therefore, the rate of return of this survey was 33 out of 150 questionnaires sent. Respondents were asked to indicate on a scale of 1 to 5, where one indicates unimportant, two relatively unimportant, three neutral, four crucial, and five very important, the relative importance of the individual factors influencing IPOs on the domestic stock exchange. Responses were further analyzed according to the age of the companies, which were divided into "young" and "mature" (<16 years, > 16 years since establishment), by the number of employees (small <250, large > 250) and by type of ownership (a large number of shareholders, family-controlled and private venture capital).

In total 15 young and 18 matured companies took part in this questionnaire. Further division of the sample is shown in Table 1.

	Variable	Frequency	Relative
Size	Small (employees)	16	48.48
	Large (employees)	17	51.52
Ownership	Widely held	18	54.55
	Family-controlled	10	30.30
	Privately held	5	15.15
Industrial sector	Manufacturing	8	24.24
	Finance	4	12.12
	Technology	6	18.18
	Services	4	12.12
	Pharmaceuticals	2	6.06
	Other	9	27.27
Country of	Bulgaria	4	12.12

Origin	Czech Republic	5	15.15
	Croatia	2	6.06
	Hungary	4	12.12
	Poland	15	45.45
	Romania	3	9.09

Tab. 1. Research sample (Source: Authors, 2022)

4 Research results

Respondents were presented with 16 statements about the relative influence of macroeconomic factors on the decision to carry out an IPO in their companies. Table 2 below shows individual statements and survey results - tables 3, 4, and 5 present partial results for questioned companies. Companies were divided by their age, size, and ownership. The following answers were reported. In total, 16 statements were given to answer. The overall degree of agreement and the average value of agreement of these answers was measured.

	Mean	Median	Mode	Mode Frequency	St. Dev.	% 4-5
A	3.36	4.00	4.00	6	1.23	54.55
B	4.12	4.00	4.00	14	1.09	87.88
C	1.73	2.00	1.00	0	0.71	0.00
D	1.61	1.00	1.00	2	1.07	6.06
E	3.64	4.00	4.00	11	1.43	72.73
F	2.52	2.00	1.00	4	1.44	30.30
G	2.36	2.00	2.00	4	1.18	12.12
H	1.79	2.00	1.00	2	1.01	6.06
I	2.12	1.00	1.00	5	1.49	21.21
J	4.58	5.00	5.00	19	0.49	100.00
K	2.27	2.00	1.00	6	1.50	24.24
L	1.58	1.00	1.00	0	0.82	6.06
M	1.39	1.00	1.00	0	0.49	0.00
N	1.39	1.00	1.00	0	0.49	0.00
O	2.55	2.00	1.00	2	1.30	30.30
P	2.45	3.00	1.00	2	1.39	30.30

Tab. 2. Overall research results (Source: Authors, 2022)

Statement A. "The very favorable GDP growth rate has reassured us that the time is right for an IPO." The positive development of GDP growth means good economic conditions for business activity. This is also the case with IPOs. More than half of the companies agreed on this (54.55% marked 4 and 5, an average of 3.36). Growth in GDP development is generally associated with growth in industrial production, which can motivate other companies to conduct IPOs.

Statement B. "Very favorable conditions in the stock market have convinced us that it is a good time for an IPO (for example, an increasing number of investors interested in buying shares)." The rise in stock index prices has the effect of attracting investors and issuers to the capital market. In such a situation, companies have a chance to raise the capital they need, and investors appreciate their wealth. Most surveyed companies agreed that positive signals from the stock market are the right impetus for conducting an IPO (88.89% indicated a value of 4 and 5, an average of 4.11).

Statement C. "We did the IPO because bank loans were too expensive (caused by the restrictive monetary policy of the central bank)." Most companies disagreed with this statement (0% marked 4 and 5, an average of 1.72). The interest rates were at their lowest, and debt capital was thus not too expensive. However, there is a problem with companies that are too indebted and cannot access capital.

Statement D. "We did the IPO because bank credit was unavailable or is only available to a limited extent (caused by restrictive monetary policy or the credit crunch)." The companies did not support this claim. (5.56% marked the values 4 and 5, an average of 1.61) In general, banks are willing to offer loans to creditworthy clients. However, financing large investment projects requires more capital, which banks do not often offer.

Statement E. "We have done the IPO. However, it was more efficient to use bank credit due to low-interest rates (caused by the central bank's expansionary monetary policy)." The vast majority of companies agreed with this statement (72.22% marked 4 and 5, an average of 3.61). Bank loans were increasingly available as a result of the expansionary policy of central banks, 1/3 of the respondents carried out an IPO during the economic crisis, i.e., at a time when interest rates were several percent higher.

Statement F. "We have done an IPO. However, it is more efficient to use subsidies now provided by the government or the EU (caused by expansionary fiscal policy)." Obtaining subsidies for investment development is a relatively administratively demanding process. Subsidies are provided for selected programs, so it may be difficult for a company to obtain them. The vast majority of companies agree with the fact that subsidies were not and are not a solution to their investment needs (27.78% marked 4 and 5, an average of 2.44).

Statement G. "We have done an IPO. However, it is more efficient to use private capital (venture capital), which domestic investors now provide." Only a minority of respondents (11.11%, an average of 2.33) fully agreed with this statement. Private capital, for example, from so-called business angels, can be risky in terms of losing the majority or complete control over the company. Individuals also usually do not have as much free capital as, for example, institutional investors or a large number of small investors.

Statement H. "We have done an IPO. However, it is more efficient to use private capital (venture capital), which foreign investors provide now." In the case of foreign investors, the attitude of the issuers is even more skeptical (5.56% indicated a value of 4 and 5, and the average is 1.83). Companies do not rely on foreign investors. Especially in Eastern European countries, foreign capital is invested in corporate branches, e.g., in the so-called green field, in the form of acquisitions of formerly state-owned enterprises, mergers, etc.

Statement I. "We have done an IPO. However, it is more efficient to use the capital provided by our parent company." This is suitable if the parent company has the capital it can lend to its subsidiary. Often, however, the IPO is carried out by the parent company itself, which can then further distribute the acquired capital. A large company also has a better chance of making a successful IPO than a smaller subsidiary. This factor was considered by only a tiny part of the respondents to be significantly motivating them to carry out an IPO (22.22% marked it with a value of 4 and 5, an average of 2.22).

Statement J. "The favorable conditions in our industry have convinced us that the time is right for an IPO." Most companies supported this statement (100% rated 4 and 5, an average of 4.56). Especially in the IT and technology sectors, stocks of successful companies are now in high demand. A positive trend in developing a particular industry will likely motivate other companies to conduct an IPO.

Statement K. "Concerns about political instability in the country played an important role in the IPO decision." Given that the research was conducted in Central and Eastern European countries that are members of the European Union, this concern was minimal among companies (5.56% indicated a value of 4 and 5, an average of 1.61). Countries such as the Czech Republic, Hungary, Poland, and others, go through major or

minor political crises, but this often does not significantly affect the economy.

Statement L. "Concerns about growing corruption in the country played an important role in the IPO decision." Corruption is a widespread phenomenon not only in the countries of Central and Eastern Europe. However, with regard to regulated markets and bodies that are active in implementing IPOs, such as the central banks, companies did not feel any concern arising from corruption (0% of respondents indicated a value of 4 and 5, an average of 1.39).

Statement M. "Concerns regarding the growing probability of state apparatus failure played an important role in the IPO decision." Even this concern was not confirmed by the company (0% indicated the values 4 and 5, an average of 1.39).

Statement N. "Concerns about rising stock market volatility played an important role in the IPO decision." Stock market volatility has been a significant factor in failed IPOs over the past decade. The great economic crisis had a substantial impact on the stock markets, and the prices of the stock indices experienced steep declines. If the main stock indexes lose their profitability, investors will lose the desire to buy shares, and thus, the investment projects of companies will stop. Surprisingly, companies are not too afraid of this volatility and do not perceive it as a threat to the IPO (27.78% marked it as 4 and 5, an average of 2.44).

Statement O. "The flow of foreign direct capital into the country has made the IPO strategy attractive for our company." Eastern and Central Europe have seen an inflow of foreign direct capital in the last three decades. However, companies that went public in these countries did not confirm this factor as decisive for the IPO (27.78% marked it as 4 and 5, an average of 2.39).

Table 3 shows the overall results when companies were divided into "old" and "young." Companies younger than 16 years were named as young. Positive GDP development and good conditions among capital markets were identified as the primary macroeconomic factors for conducting IPO among both old and young companies. More mature companies, probably due to higher capital needs, looked for IPO implementation.

Young companies						
	Mean	Median	Mode	Mode Frequency	St. Dev.	% 4-5
A	3.13	3.00	3.00	2	1.26	40.00
B	4.00	4.00	4.00	6	1.26	86.67
C	1.67	2.00	1.00	0	0.70	0.00
D	1.53	1.00	1.00	0	0.72	0.00
E	2.60	2.00	1.00	2	1.50	40.00
F	2.07	2.00	2.00	0	1.00	13.33
G	2.20	2.00	3.00	0	0.83	0.00
H	1.67	2.00	2.00	0	0.60	0.00
I	1.53	1.00	1.00	0	0.81	0.00
J	4.53	5.00	5.00	8	0.50	100.00
K	2.07	2.00	2.00	2	1.24	13.33
L	1.27	1.00	1.00	0	0.44	0.00
M	1.40	1.00	1.00	0	0.49	0.00
N	1.40	1.00	1.00	0	0.49	0.00
O	2.20	2.00	1.00	0	1.05	13.33
Old companies						
	Mean	Median	Mode	Mode Frequency	St. Dev.	% 4-5
A	3.56	4.00	4.00	4	1.17	66.67
B	4.22	4.00	4.00	8	0.92	88.89

C	1.78	2.00	2.00	0	0.71	0.00
D	1.67	1.00	1.00	2	1.29	11.11
E	4.50	4.50	4.00	9	0.50	100.00
F	2.89	3.00	1.00	4	1.63	44.44
G	2.50	2.00	2.00	4	1.38	22.22
H	1.89	1.50	1.00	2	1.24	11.11
I	2.61	2.00	1.00	5	1.74	38.89
J	4.61	5.00	5.00	11	0.49	100.00
K	2.44	1.50	1.00	4	1.67	33.33
L	1.83	2.00	1.00	0	0.96	11.11
M	1.39	1.00	1.00	0	0.49	0.00
N	1.39	1.00	1.00	0	0.49	0.00
O	2.83	3.00	4.00	2	1.442	44.44

Tab. 3. Old vs Young companies (Source: Authors, 2022)

Table 4 provides results based on the size of companies. Companies were divided into “small” and “big.” Small companies had up to EUR 50 ml. of own equity, less than 250 employees, and their sales were less than EUR 43 million. On the other hand, big companies had more than EUR 50 million, more than 250 employees, and more than EUR 43 million in sales.

Small companies						
	Mean	Median	Mode	Mode Frequency	St. Dev.	% 4-5
A	3.69	4.00	4.00	5	1.21	62.50
B	4.50	4.50	4.00	8	0.50	100.00
C	1.63	1.00	1.00	0	0.78	0.00
D	1.50	1.00	1.00	1	1.06	6.25
E	3.75	4.00	4.00	6	1.39	75.00
F	2.56	2.00	1.00	2	1.58	43.75
G	2.44	2.00	2.00	2	1.12	12.50
H	1.94	2.00	2.00	1	0.97	6.25
I	2.19	1.50	1.00	2	1.47	25.00
J	4.75	5.00	5.00	12	0.43	100.00
K	2.44	2.00	1.00	3	1.54	31.25
L	1.81	2.00	1.00	0	0.95	12.50
M	1.44	1.00	1.00	0	0.50	0.00
N	1.44	1.00	1.00	0	0.50	0.00
O	2.63	3.00	3.00	1	1.22	25.00
P	2.63	3.00	1.00	1	1.32	31.25
Big companies						
	Mean	Median	Mode	Mode Frequency	St. Dev.	% 4-5
A	3.06	3.00	4.00	1	1.16	47.06
B	3.76	4.00	4.00	6	1.35	76.47
C	1.82	2.00	2.00	0	0.62	0.00
D	1.71	1.00	1.00	1	1.07	5.88
E	3.53	4.00	4.00	5	1.46	70.59
F	2.47	2.00	1.00	2	1.29	17.65
G	2.29	2.00	2.00	2	1.23	11.76
H	1.65	1.00	1.00	1	1.03	5.88
I	2.06	1.00	1.00	3	1.51	17.65
J	4.41	4.00	4.00	7	0.49	100.00
K	2.12	2.00	1.00	3	1.45	17.65
L	1.35	1.00	1.00	0	0.59	0.00
M	1.35	1.00	1.00	0	0.48	0.00

N	1.35	1.00	1.00	0	0.48	0.00
O	2.47	2.00	1.00	1	1.38	35.29
P	2.29	1.00	1.00	1	1.45	29.41

Tab. 4. Small vs Big companies (Source: Authors, 2022)

Table 5 shows results divided by the ownership of the companies. The privately held, family-owned, and widely owned companies were asked to give their opinions on selected statements.

Widely owned companies						
	Mean	Median	Mode	Mode Frequency	St. Dev.	% 4-5
A	3.56	4.0	4	4	1.21	61.11
B	4.28	5.0	5	10	1.10	88.89
C	1.83	2.0	2	0	0.69	0.00
D	1.39	1.0	1	0	0.59	0.00
E	3.72	4.0	4	5	1.28	77.78
F	2.56	2.0	2	2	1.26	22.22
G	2.17	2.0	2	0	0.60	0.00
H	1.67	2.0	1	0	0.67	0.00
I	1.67	1.0	1	1	1.11	5.56
J	4.50	4.5	4	9	0.50	100.00
K	2.44	2.0	1	3	1.46	27.78
L	1.33	1.0	1	0	0.58	0.00
M	1.33	1.0	1	0	0.47	0.00
N	1.28	1.0	1	0	0.45	0.00
O	2.72	3.0	1	2	1.37	33.33
P	2.44	2.5	1	2	1.38	22.22
Family owned companies						
	Mean	Median	Mode	Mode Frequency	St. Dev.	% 4-5
A	3.20	3.5	4	2	1.33	50.00
B	3.70	4.0	4	2	1.19	80.00
C	1.70	1.5	1	0	0.78	0.00
D	2.30	1.5	1	2	1.55	20.00
E	3.10	4.0	4	2	1.58	60.00
F	2.90	3.5	1	2	1.64	50.00
G	2.20	1.5	1	2	1.54	20.00
H	2.10	1.5	1	2	1.51	20.00
I	2.50	1.5	1	2	1.69	40.00
J	4.80	5.0	5	8	0.40	100.00
K	2.50	2.0	1	3	1.69	30.00
L	2.00	2.0	2	0	1.10	20.00
M	1.40	1.0	1	0	0.49	0.00
N	1.70	2.0	2	0	0.46	0.00
O	2.70	3.0	4	0	1.27	40.00
P	3.00	4.0	4	0	1.34	60.00
Privately owned companies						
	Mean	Median	Mode	Mode Frequency	St. Dev.	% 4-5
A	3.0	3.0	2	0	0.89	40
B	4.4	4.0	4	2	0.49	100
C	1.4	1.0	1	0	0.49	0
D	1.0	1.0	1	0	0.00	0
E	4.4	5.0	5	4	1.20	80

F	1.6	1.0	1	0	1.20	20
G	3.4	3.0	5	2	1.36	40
H	1.6	2.0	2	0	0.49	0
I	3.0	2.0	5	2	1.67	40
J	4.4	4.0	4	2	0.49	100
K	1.2	1.0	1	0	0.40	0
L	1.6	2.0	2	0	0.49	0
M	1.6	2.0	2	0	0.49	0
N	1.2	1.0	1	0	0.40	0
O	1.6	2.0	2	0	0.49	0
P	1.4	1.0	1	0	0.80	0

Tab. 5. Companies' answers according to ownership (Source: Authors, 2022)

5 Discussion

According to the literature, three main theoretical explanations exist for the IPO timing phenomenon. The first theory states that firms enter capital markets under favorable economic conditions that support their continuous growth and development (Loughran & Ritter, 1995; Ritter & Welch, 2002). The results of this study support this theory. First, a very favorable GDP growth rate reassured the respondents that the time was right for an IPO when 54.55% agreed with this fact. That went hand in hand with the effect of favorable conditions in the stock market. The rise in stock index prices has the effect of attracting investors and issuers to the capital market. 88.89 % of the surveyed companies agreed that positive signals from the stock market were the right impetus for conducting an IPO.

De Alborno and Pope (2004) found that the IPO is affected by the market valuation of companies in the same industry. That is when there is a positive development in the sector where the company operates or directly related sectors. In cases where competing companies have implemented IPOs successfully, other comparable companies are likely to want to gain the same benefits as the issuing competition.

Another theory says that companies enter capital markets when other companies also enter these markets (Choe, Masulis, and Nanda, 1993). The results of this study also follow this theory. Most companies supported this statement (100% rated 4 and 5, an average of 4.56). A positive trend in developing a particular industry will likely motivate other companies to conduct an IPO.

6 Conclusion

The paper aimed to identify macroeconomic factors influencing IPO implementation in selected Central and Eastern European capital markets. Survey-based research has been conducted within a sample of non-financial companies operating in the Czech Republic, Croatia, Hungary, Poland, and Romania. The results show that most companies implement IPO when favorable economic conditions mean GDP grows. The favorable conditions in the stock market also convinced them to go ahead with IPO. However, rising stock market volatility was a negative factor while implementing the IPO decision process. When competitors were implementing IPO, most respondents saw this as a signal to go for their market entry. At the time of this research, most banks maintained meager interest rates, but that was not the motive for IPO. The companies had access to cheap bank credit. However, loan capital was not an option anymore to support their growth. The subsidies widely used to extend the businesses in the EU were also the least available option than IPO capital. The majority of respondents dumped the venture capital from domestic or foreign investors. Most companies instead preferred capital from parent companies abroad. The state-related issues like concerns for government instability, rising corruption, or failure of the state probability were not significant issues in IPO implementation. Under the conditions of the CEE region, companies that went public in these countries

did not confirm the inflow of foreign direct capital factor as decisive for the IPO.

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Primary Paper section: A

Secondary Paper Section: AH

STRATEGY FOR PROMOTING INNOVATIVE PRODUCTS IN INTERNATIONAL MARKETS

^aOLGA PRYGARA, ^bTETIANA NAGACHEVSKA, ^cALLA STAROSTINA, ^dOLENA KUZIOMA, ^eNATALIYA MOSKALYUK

^a*Taras Shevchenko National University of Kyiv, Kyiv, Ukraine*

^b*Taras Shevchenko National University of Kyiv, Kyiv, Ukraine*

^c*Taras Shevchenko National University of Kyiv, Kyiv, Ukraine*

^d*Taras Shevchenko National University of Kyiv, Kyiv, Ukraine*

^e*Kyiv National Economic University named after Vadym Hetman, Kyiv, Ukraine*

email: ^aolgaprygara@knu.ua, ^btetiananagachevska@knu.ua,
^callastarostina@knu.ua, ^dolenakuzioma@knu.ua,
^emoskalyuk.nataliya@kneu.edu.ua

Abstract: The study proposes methodological approaches for promoting innovative products in international markets. Peculiarities of international promotion and barriers to innovation diffusion in the market have been identified. The proposed strategy formation model for promoting innovations in international markets takes into consideration the characteristics of the innovation, consumer behavior patterns, and consumer resistance to innovations. A specific innovative product in the US market is selected to test the model, and marketing research is conducted. The marketing research outcomes include insights into consumer motivations, and perception of innovations in the US plant-based meat market, which can serve as valuable input for companies while their promotion.

Keywords: innovative product, promotion strategy, international markets, international economic activity.

1 Introduction

In today's global economy driven by innovation, it is crucial for companies to continuously monitor the market and adapt their products, services, and working methods to maintain competitiveness. The implementation of innovative strategies serves as a key competitive advantage for companies, as it not only provides value to consumers but also positively influences competitiveness indicators in international markets while contributing to social responsibility. The rapid progress of science and technology, along with the swift commercialization of research and development, combined with intensified international competition in launching innovative products, have significantly influenced entrepreneurial activities. In light of these circumstances, the development of effective and successful strategies to promote innovative products in both domestic and international markets is an urgent priority that can secure competitive advantages and foster innovative leadership.

In order to tackle this challenge, it is essential to identify the crucial factors and attributes of product promotion in a dynamic global environment, particularly considering the pervasive influence of digitization in the economy. This knowledge can then be leveraged in the development of effective promotion strategies. With the ongoing advancements in science and technology, promotional tools are continuously evolving, making communication an increasingly vital component of marketing efforts for businesses operating in international markets. The competitive landscape is further intensified by aggressive communication policies employed by rival companies, aiming to capture larger market shares and targeting diverse market segments. This highlights the growing significance of communication in marketing and the international economic activities of innovative enterprises.

Numerous studies are devoted to the theoretical and practical aspects of developing a promotion strategy and its tools in companies' international economic activities.: Aaker D., Blyde J., Burnet J. and Moriarty S., Kotler P., Leikhif J., Lambin J-J., Ogivli D, Balabanova L., Kanishchenko O., Kochkina N., Lukyanets L., Primak T., Starostina A., etc. The problems of innovations and innovative development of international companies were considered in the works of Tidd J., Besant J., Pewitt K., Rothwell R., Cooper R., Porter M., Rogers E., Praude V., Starostina A., etc.

Despite the extensive research on innovations, product promotion strategy development, and individual elements of the marketing communications system, there has been a lack of research devoted to understanding the nuances of developing a promotion complex for innovative products on international markets. Given the high degree of competition, the dynamism of market environment factors, and the shortening of the life cycle of innovations, this issue has become particularly pertinent. Thus, *the aim of this research* is to propose a model for developing a strategy to promote innovative products in the modern, dynamic, and highly competitive international business environment, considering digitalization, along with practical recommendations based on the application of this model.

To achieve the stated objective research goals are the following:

- to identify the characteristics of promoting innovative products in modern conditions;
- to develop a strategy formation model for promoting innovative products in international markets;
- to test strategy formation model for promoting innovative products in international markets using the example of a selected innovative product in the US market, based on expert evaluations and conducted marketing research.

2 Literature review

A promotion strategy is used by companies to inform, persuade or remind consumers about goods, services, ideas, activities, etc. According to Burnett, J., & Moriarty, S. (1998) promotion is a process, due to which information about the product is transferred to the target audience. Blythe J. (2000) defines promotion strategy as a process of transfer of information about the product to the target audience, which provides them with an idea of the general strategy of the company by directing special appeals about the product, its price, and means of transmission. A common feature of numerous definitions of promotion strategy lies in the importance of informing consumers and intermediaries about the company's products and the company in general with the help of appropriate tools. The least highlighted component in most definitions is the result of the promotion strategy, and this component remains almost overlooked by researchers. A common element in the interpretation of the goal of promotion strategy is to achieve agreement and ensure long-term relations with counterparties on a mutually beneficial basis. Systematization and critical analysis of scientific sources on the topic made it possible to define the promotion strategy for innovative products as a way for the enterprise to achieve long-term goals, which coincides in the formation of a set of communication and sales tools to inform consumers about innovative products, intensifying their sales, establishing long-term mutually beneficial relations and forming a positive image of the company in the market.

Numerous studies in international promotion emphasize the necessity for strategy adaptation to an international market. The specifics of the promotion strategy in international business lie in differences in the business environment of home and host country. The factors influencing the international communication process are the factors of the market environment of the domestic and foreign markets: political-legal, economic, socio-cultural, demographic, scientific-technical, and geographical factors, which are characterized by a high degree of dynamism, unpredictability, and uncertainty. And especially relevant factors of influence are factors of sociocultural, linguistic, economic, and legislative differences and factors specific to the competitive situation on the market, greater costs for promotion due to remoteness, costs for cross-border movements, etc. (Hollensen, 2000). Promotion strategy adaptation is the extent to which the firm's domestic promotional program is customized to the export market (Lages, Abrantes, and Lages, 2008). The importance of conducting a strategic analysis of international markets, conducting a comprehensive examination of the socio-cultural

environment, and thoroughly analyzing secondary and primary marketing and economic information has become increasingly critical. This is due to the differences in market behavior among customers on the international market.

To develop a successful strategy for implementing innovation in the market, including the promotion of innovative products, it is crucial to conduct a thorough examination of consumer purchasing behavior characteristics and identify barriers to the adoption of innovation.

The promotion of innovative products possesses certain distinctive features compared to well-established products in the market, which are associated with their unique characteristics and the presence of consumer resistance towards the adoption of innovations. It is important to determine the barriers to the adoption of innovation and their impact on consumer behavior, making purchase decisions. Strategy formation of innovative products is characterized by certain specifics compared to market-known goods related to their features and the consumer resistance to the spread of innovations. E. Rogers emphasizes the innovative characteristics that are key success factors of new products (Rogers, 2003). Along with this, a number of other of scientific research focus on the barriers to the adoption of innovations by consumers. This is especially relevant for the process of technological implementation innovations. When studying consumer resistance, two categories of barriers are recognized (Ram, Sheth, 1989; Ram, 1989; Claudy, Garcia, O'driscol, 2021):

- functional barriers, when consumers evaluate the consequences from a point of view of use, cost, and risk;
- psychological barriers, which mostly arise due to conflicts with the previous beliefs of consumers.

Based on the study of scientific sources (Henard and Szymanski, 2001, Montoya-Weiss and Calantone, 1994, Cooper and Kleinschmidt, 1987), four groups of factors for the implementation of a new product on the market can be distinguished: the market (intensity of competition, likely reaction of competitors, market potential), characteristics of the innovative product (satisfaction of consumer needs, relative utility, technological complexity), characteristics of the company's strategy (technological synergy, market synergy, human resources, and R&D), characteristics of the innovation process (marketing task, predevelopment task, technological and launch proficiencies, cross-functional integration and communication).

The format that companies use to convey information about product innovations is of high importance for the market success of these innovations (Noseworthy and Trudel 2011; Reinders, Frambach, and Schoormans 2010; Townsend and Kahn 2014; Wood and Moreau 2006). Traditional information presentation formats often fail to stimulate and effectively communicate the advantages of these innovations (Wood and Lynch, 2002).

An ineffectively developed strategy for the promotion of innovative products can lead to the following negative consequences (Praude et al, 1994):

- non-acceptance and misunderstanding of the novelty by the consumer, insufficient level of readiness for it;
- the oversaturation of dependent and morally obsolete goods;
- an increase in the time it takes to introduce an innovative product to the market due to insufficient prior consumer awareness;
- loss of competitive advantage, namely the priority of commercialization of an innovative product;
- deviation of the actual profitability (of the innovative product and its promotion strategy) from the planned downwards, failure to achieve the planned marketing and financial goals of the strategy;
- reduction of the scientific, technical, and technological level of the economic entity, etc. (the violation of financial

plans for the implementation of the strategy reduces the possibilities of financing the R&D of the enterprise and its innovative potential).

Therefore, *the purpose of this research* is to develop mechanisms for strategy formation to promote innovative products in international markets based on identifying their characteristics, factors, stages, and promotional tools.

3 Methodology

Applying the method of systematization and factor analysis, the features of innovative products and their promotion processes were identified, and the correlation between the features of the innovative product, its category, and the choice of more effective tools of the promotion complex were determined. Based on the application of the method of synthesizing theoretical positions of scholars and their critical analysis, the investigation of strategic management principles in marketing and international business activities, and the hypothesis method, a model for formulating a strategy to promote innovative products have been developed. To validate the proposed model using the example of an innovative product such as plant-based meat in the US market, a data collection and processing method was employed, and a marketing research study was conducted, including surveys of the target audience. Based on the findings, recommendations for the promotional strategy were formulated.

4 Research results

The strategy of a company actively implementing innovations should be built upon considering the specific nature of innovative products, in contrast to traditional goods. It should be based on assessing favorable and limiting factors in the business environment and aimed at maximizing economic efficiency while reducing financial and labor costs associated with the development and implementation of the innovation promotion or product differentiation strategy.

Based on the identification of differences between innovative products and traditional ones, the following characteristics of an innovation promotion strategy have been determined:

- rapid aging of the innovative product;
- high level of competition;
- high degree of dynamism of the market environment;
- high level of expenses at the stage of developing an idea and introducing an innovative product to the market, which subsequently leads to a limited budget for the implementation of effective promotion strategy tools;
- high speed of copying the main characteristics of the innovative product by competitors;
- peculiarities of consumer demand, for example, consumers' devotion to traditional goods, ignorance of innovations, mistrust of novelties, reluctance to spend more money for innovation, etc.

The following hypotheses were proposed to identify key aspects of the mechanisms for developing a strategy to promote innovative products in international markets:

H1. Innovation characteristics have a key influence on the promotion of innovative products in international markets.

H2. Identifying the characteristics of consumer behavior when purchasing an innovation is a necessary stage in developing a strategy for promoting an innovative product on international markets.

H3. Assessment and consideration of barriers of innovation perception is a mandatory component of developing a strategy for the promotion of an innovative product.

These hypotheses were confirmed and taken into account in the authors' research through the process of surveying and analyzing the results.

Based on upon extensive scientific research on this matter and the author's own study, which identified the characteristics of the innovative product and factors influencing its promotion, as well as the specifics of implementing and realizing innovative products in the market, a model for developing a strategy to promote innovative products in international markets was developed by the authors (Fig. 1).

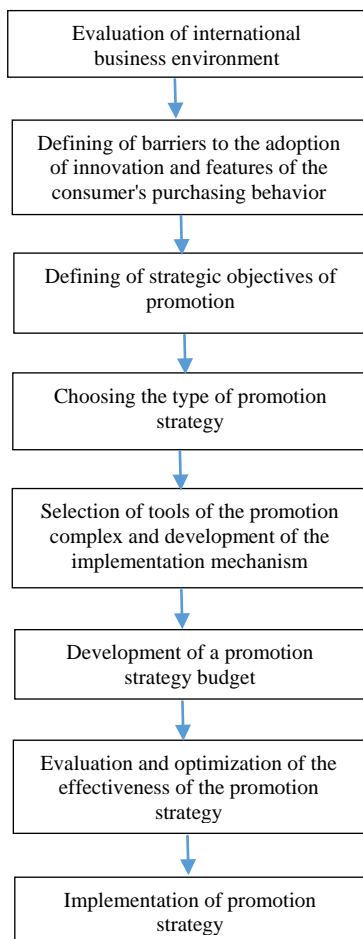


Fig1. Strategy formation model for promoting innovative products in international markets
Source: own elaboration

The first stage of strategy formation for promoting innovative products involves monitoring the external and internal market environment and is carried out in order to set strategic goals for company's development. This stage includes business environment analysis and SWOT analysis. The implementation of this stage helps to set an actual goal and to choose relevant promotion tools. In the aspect of analyzing the macro marketing environment, it is necessary to analyze the political-legal, economic, cultural, socio-demographic, geographical, and scientific-technical factors affecting the company's activity on the market. Factors of the micro marketing environment include the activities of consumers, competitors, suppliers, intermediaries, and contact audiences.

The next stage is to determine the barriers to the perception of the innovation and the characteristics of the consumer's purchasing behavior. Taking into account the difference between innovative products and traditional ones the following features of promotion strategy for innovations can be determined:

- high level of unpredictability and volatility of the market of innovative goods and the business environment in which the innovation process is carried out;
- the necessity of taking into account the peculiarities of the purchasing behavior of the potential consumer of the

innovative product and the level of his perception of innovations;

- dependence of the type of promotion on market goals and innovation strategies of the enterprise, as well as the category of the innovative product;
- dependence of the goals and tools of the promotion strategy on the type of innovation;
- necessity of development of a promotion complex in accordance with the life-cycle stage of innovation;
- impact of innovative product positions in the company's product portfolio on the development of a promotion strategy;
- the existence of consumers' barriers in the process of adapting to the innovative product;
- difficulties in evaluating the effectiveness of the communication complex.

Consumer resistance to the perception of innovations depends on the following factors: 1) innovation characteristics; 2) customers' characteristics and risks; 3) marketing strategy; 4) business environment factors (Fig. 2)

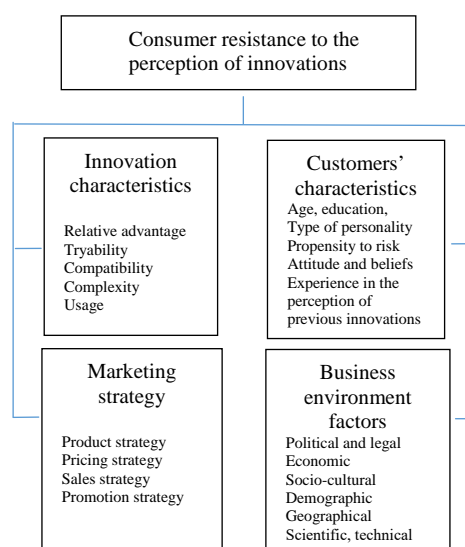


Fig. 2. Consumer resistance to the perception of innovations
Source: own elaboration

The third stage of strategy formation model comprises defining both strategic and operational objectives. The strategic objective is to attain a specified market share, sales volume, and profit level for the innovative product.

As defined at the previous stage, the strategy formation model depends on the product's innovative characteristics and the peculiarities of the consumer's purchasing behavior. Therefore, the communication goals of innovation promotion are the following:

- informing about the value and advantages of an innovative product compared to a traditional one;
- informing about the way to use and maintain the product;
- informing about the possible risks associated with the use of the innovative product or ways to minimize them and safe use of the product;
- informing about possible types of services, that are provided for consumers of the innovative product;
- formation of the image of a reliable product with a high degree of relative advantage, value, tryability, compatibility, possibility of evaluation and a low degree of complexity;
- formation of a positive image of the product.

At the fifth stage of the strategy formation model for promoting innovative products the tools of the promotion complex are selected - advertising, public relations, sales promotion, direct marketing, and the development of mechanisms for the implementation of the strategy.

When strategy formation for penetrating an innovation to the market, including a promotion strategy, there is a need to clearly define the category of the innovative product and take into account its specifics. Table 1 shows the communication goals and recommendations for the elements of the promotion complex of various categories of innovative products.

Table 1. Communication goals and recommended elements of promotion mix of various categories of innovative products

Level of innovativeness of products	Advertising costs	Communication goals	Recommended elements of the promotion mix
New-to-the-world	Exceed production costs	- informing about the situation and method of using the product; - informing about innovative characteristics (relative advantage, compatibility, tryability) - informing about the absence of risks associated with the use of the product	Informative advertising, PR
Additions to existing product lines	High costs	-informing about the expansion of the assortment, the method of use, and situations of use of the product; - informing about the absence of risks associated with the use of the product or ways to minimize them; - formation of a positive image of the product	Informative advertising, PR, sales promotion
Products improvements	Low costs	- informing about the advantages of the improved product, the way to use and maintain the product; - formation of a positive image of the product	Informative advertising, PR, sales promotion
Repositioning	Costs are increasing	- informing about the change in positioning, the situation, and the method of using the product; - informing about possible ways of service and support for consumers of the innovative product	Advertising, PR of innovative goods on a new market
Costs reductions	Low costs	- forming a belief about a high degree of relative usefulness, tryability, compatibility, evaluation possibilities, and a low level of complexity. - formation of a positive image and recognition of the product	Advertising, sales promotion

After determining the elements of the promotion complex, a detailed program of their implementation is developed, and planning of advertising strategy, PR strategy, sales promotion, and personal selling activities is carried out. The promotion strategy is aimed to overcome customer's barriers to the innovations diffusion process (table 2).

Table 2. Recommendations for overcoming barriers of innovations diffusion due to promotion strategy

Barriers	Characteristics of barriers	Features of the promotion strategy
Tradition barrier	Values, beliefs, attitudes and perceptions, consumer culture	Informative advertising with an emphasis on the functional advantages of the innovative product possibility of trial period
Value barrier	Perception of the new product as identical to existing ones, without the additional functional characteristics	Advertising to increase awareness and direct marketing to emphasize benefits
Risk	Functional, social, financial, waste of time	Informative advertising, advertising message - emphasis on compliance with all requirements and standards, influence marketing, after-sales service
Psychological factors	Attitude to the brand, potential impact on social status, compliance with social norms	Combination of emotional and rational advertising, public relations, event marketing, loyalty programs

To implement the promotion strategy, it is essential to develop a comprehensive plan that includes schedules, task allocation, and a media plan. Each tool within the promotion program must be carefully considered, and decisions should be made accordingly. The allocation of responsibilities to designated personnel and the establishment of monitoring and control mechanisms are critical to ensuring timely execution of each task within the promotion complex. The subsequent phase encompasses the allocation and distribution of the promotion budget for executing the planned actions. However, given the distinctiveness of promoting innovative products, the process of budget formation should be approached with careful consideration of aligning the budgeting method with the established goals and objectives.

Evaluation of the effectiveness of the promotion complex is carried out according to two key approaches: evaluation of economic effectiveness, as an analysis of the relationship between the implemented marketing communications campaign and the change in the financial and economic results of the enterprise, caused by the influence of the promotion complex. Effectiveness evaluating also involves determining the level of profitability of marketing investments and their payback period. In this case, it is crucial to evaluate the potential increase in income and profits resulting from the implementation of the marketing measures and associated costs. This assessment is used to optimize the list of measures and costs, ensuring profitability, payback, and an acceptable level of return. It is also important to evaluate the communicative effectiveness of the developed tools in promoting the product, which can impact the relationships between market players and affect the economic situation of the company. Finally, the last stage involves the implementation of the promotion strategy and assessing the actual effectiveness of the developed measures, including the achievement of strategic goals and planned indicators.

Let's consider the peculiarities of strategy formation for the promotion of innovative products using the example of plant-based meat (vegan meat) in the US market.

Vegan meat is an innovative product, a meat substitute made from plant-based ingredients, has been growing in popularity in recent years due to the increasing demand for sustainable and ethical food options. The U.S. market is one of the biggest markets for vegan meat, and it presents a significant opportunity for plant-based companies. Several plant-based meat companies have already established a presence in the U.S. market, including Beyond Meat and Impossible Foods. These companies have partnered with major fast-food chains and grocery stores to offer plant-based meat products. This suggests high probability rates of vegan meat adoption in the U.S. culture of consumption. The openness of the U.S. market in terms of vegan meat perception also presents an opportunity for plant-based meat companies to innovate and create new products.

Vegan meat is designed to mimic the taste, texture, and appearance of real meat, but without the environmental and ethical concerns associated with animal agriculture. Taking in consideration customer's barrier to innovation perception there are some challenges that plant-based meat companies will need to overcome in order to succeed in the U.S. market:

- 1) high cost of plant-based meat is a barrier to consumers' adoption of innovative products;
- 2) skepticism among consumers about the taste and texture of plant-based meat, which may require more marketing efforts to overcome;
- 3) prejudice that persists among consumers about the quality of this product and the adequacy of its nutritional value in comparison with traditional meat.

Since the main ingredient of plant-based meat is soy, some prejudice persists among consumers about the quality of this product and the adequacy of its nutritional value in comparison with traditional meat. In order to establish consumers' motivations while purchasing plant-based meat in the U.S. for promotion strategy formation market the research was fulfilled.

In line with hypotheses (H1, H2, H3) to identify innovation characteristics of the product, peculiarities of consumer behavior, and barriers of innovation perception, research objectives, and questions were defined (table 3).

Table 3. Research objectives and questions for investigating customer’s motivations in the perception of plant-based meat

Research objectives	Research questions	Description
Innovation characteristics (H1)	What may serve as a main motivation for consumers to switch from traditional meat to plant-based?	To determine the relative advantage of plant-based meat alternatives over the traditional one
	Can plant-based meat provide customers with superior nutritional value and taste? Are there some benefits of plant-based meat?	To determine the relative advantage of plant-based meat alternatives over the traditional one
Characteristics of consumer behaviour (H2)	What kind of diet do consumers follow the most?	To determine settled consumer behaviour and whether the diet would serve as a determinant of the level of customers’ plant-based consumption
	What do consumers derive from eating traditional meat?	To research what may stop a traditional meat consumer from eating vegan meat, in case it could not match the particular benefits of traditional meat.
	How integrated is meat into a consumer’s daily diet? How frequently do they consume meat?	To research previous practices and the level of meat loyalty. The more frequently consumer eats regular meat, the harder it would be for them to switch to plant-based alternatives
	How concerned are consumers of how their purchase behaviour impacts the environment?	If the consumer does not care for the environment, they may not be motivated by negative environmental factors of a traditional meat industry to switch to plant-based meat
	How concerned are consumers about their health and whether or not they have some chronic health conditions, such as cardiovascular diseases, obesity, etc?	To determine potential problems which may arise from constant consumption of traditional meat in order to leverage them in the future to promote the transition to the healthy alternative – plant-based meat
Barriers of innovation perception (tradition barrier, value barrier, risk, psychological factors) (H3)	What is the role of traditional food in customers eating habits?	Determination of traditional barriers that may prevent consumers from purchasing plant-based meat
	What is consumer perception of soy products and its presence in meat products?	To determine social norms and beliefs about soy. There is a perception that meat products containing any level of added soy to the ingredient list are considered to be of inferior quality
	What are the factors that can prevent customers from switching to plant-based meat?	Determination of value, risk, and psychological factors that can prevent consumers from purchasing plant-based meat

A questionnaire was composed to gather marketing data, and a survey was conducted to investigate consumer motivations for purchasing plant-based meat in the U.S. market. The research involved 36 participants. The demographic profile of the sample is presented in table 4.

Table 4. Demographic profile of the sample

Measure	Absolute values	Percentages
Gender		
Male	10	27,8%
Female	26	72,2%
Meat consumption		
Yes	34	94,4%
No	2	5,6%
Age		
20-30	20	55,6%
31-40	4	11,1%
over 46	12	33,3%

The analysis of the collected data yielded the following outcomes. Upon examining the participants’ dietary habits, a correlation between their eating patterns and their perception of conventional meat was observed. A majority of 86.1% of respondents reported not having any specific dietary restrictions or following a particular diet.

To examine the regularity of traditional meat consumption and the degree of consumers’ fondness for this product, a relevant question was posed. As a result, it was determined that 66.7% of respondents regularly consume meat at least once a week, while another 25% consume meat regularly but with less frequency, multiple times a month, while 5.6% of the respondents do not consume meat. We included a question in the survey to understand the motivating factors behind traditional meat consumption. The results showed that taste is the primary motivator for 47.2% of respondents, followed by the high nutritional value of meat. Long-term satiety ranked third in the level of significance among consumers. The proximity of the product and the desire to stay close to cultural cuisine were the least significant motivators for consumers (Fig.3).

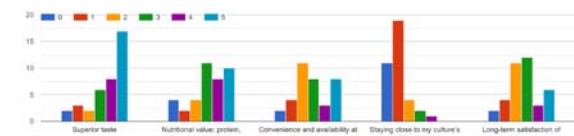


Fig. 3. Factors by the level of their importance for consumers in assessing benefits from eating a traditional meat

Therefore, we can conclude that taste profile and nutritional value are the main drivers in consumers’ behavior when choosing to buy meat. That allows us to assume that in order to encourage such people to switch to plant-based meat, they would thoroughly examine how this type of product compares to traditional meat in taste and nutritional value. In case vegan meat would not match the traditional one in these criteria, consumers would not opt for them.

Since we established that the taste factor is a primary driver of consumer choice here, it is essential to measure the consumer’s belief towards difference in vegan and traditional meats’ taste profiles. The results are the following: 41,7% of respondents believe that vegan meat could match the taste profile of traditional meat, while 36,1% of them hesitate to answer and only 22,2% believe that this notion is false. All things considered, those respondents who believe that vegan meat could match the taste profile of a traditional one or hesitate to answer are the exact audience that needs to be targeted by vegan meat producers, because as long as their product satisfies their main demand – taste, it has a chance to compete with traditional product.

Another important factor to measure in this research is consumers’ attitudes toward soy. A few decades ago soy was perceived as a replacement for traditional meat products in the ingredient list, intended to cheapen their production and increase the volume by also minimizing the content of real animal-derived ingredients. Since modern innovative vegan meat is produced primarily of soy and since its price is usually higher than those of traditional meat, consumers may face a dissonance and be hesitant to opt for this new product on the market.

To take a more in-depth view of consumers' attitudes towards soy, an additional question was asked to measure if they would consider vegan soy meat a decent alternative to replacing traditional meat. 38,9% disagree with the notion that soy products are designed to cheapen the production of meat and therefore they could not be considered a decent alternative to animal meat. 44,4% of respondents hesitate to state their attitude towards this issue, while 16,7% expressed a level of agreement. Summing up, we can establish that at least 38,9 to 83,3% of respondents would not have any prejudice against soy being a primary ingredient of vegan meat, therefore it would not be a barrier to purchase.

As we described previously, the main facilitator of vegan meat market growth was the environmental concerns of modern consumers about the detrimental effect that traditional meat production has on the ozone layer and soil and water contamination levels. Thus, we can assume that those respondents that have a high level of environmental awareness and strive for minimizing the negative effect of their choices on the environment would be a target audience for plant-based meat. To understand the scale of this target audience several questions were asked.

First of all, we identified that 58,3% of respondents in the U.S. market have high self-assessed levels of environmental awareness, while 25% consider it average (Fig.4).

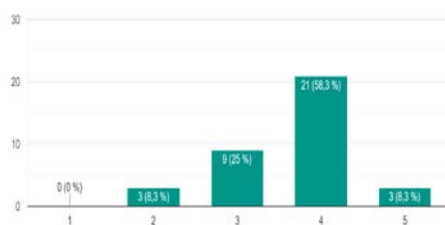


Fig.4. Rate of environmental awareness

Nevertheless, only 2,8% of respondents put the highest level of effort into minimizing the impact their consumer choices have on the environment, while 33,3% consider them rather high, another 41,7% - mild, and the last 22,2% rather low (Fig.5). From this data, we can deduce that vegan meat's positioning as environmentally friendly would resonate approximately with 36,1% of consumers, while others would not be that willing to make an effort to minimize the impact their meat consumption has on the environment.

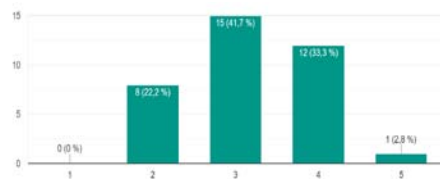


Fig. 5. Evaluation of the level of consumer effort to minimize the impact of their choices on the environment

Another important aspect to measure here is the level of awareness consumers have about this detrimental effect that the traditional meat industry has on the environment. In our research, we established that 30,6% of respondents have a strongly negative attitude towards the negative impact of the meat industry on our environment, while also 33,3% expressed a somewhat negative attitude. This constitutes 63,9% of the consumers that may be targeted by vegan meat producers using the argument of the traditional meat industry's drawbacks and presenting an alternative – sustainable vegan meat. 36,1% of respondents express either indifference to this issue or their doubts about its relevance.

In order to identify potential barriers preventing consumers from switching to plant-based meat despite its environmental benefits, a specific question was included in the survey. Among the highest barriers to switching from animal to plant meat are: concerns about the disparity in their nutritional values, and concerns about the quality and taste profile. Apart from that, the price also serves as a deterrent factor to switching. In order to overcome these barriers, manufacturers of these innovative vegan-meat products should address the aforementioned concerns in their marketing mix and promotional campaigns.

While additionally discovering factors that may incentivize vegan meat purchasing, it was established that equality in their taste profiles would serve as a main motivation to try this innovative vegan meat product, while also its benefits in mitigating negative health conditions and animal-cruelty prevention, as well as sustainability are considered important motivational factors for purchase. These benefits should also be leveraged by manufacturers in their marketing mix.

Summing up, the conducted research has shown us that the majority of respondents are traditional meat eaters and have a high culture of this product's consumption. Nevertheless, vegan meat has a huge potential in the U.S. market considering the high level of consumers' concerns about the traditional meat industry's impact on the environment, as well as the low level of prejudice against soy as an ingredient. Like any innovative product, plant-based vegan meat also faces several barriers to its promotion. One of the biggest obstacles preventing Americans from switching to vegan meat is their concern that it may not match the taste and nutritional value of animal meat products, although they acknowledge that it is possible. Pricing also plays a major role in consumers' reluctance to try the product, as they see no reason to pay a higher price for a product they have doubts about. Given that traditional meat is valued for its taste, nutritional value, and ability to satisfy hunger for a long time, a promotion strategy for plant-based meat products should focus on these factors, which are the main barriers to perception – lack of value and relative advantage of the product.

Based on this, a promotion strategy can be proposed for companies operating in the plant-based meat market. The results indicate that the goal of the promotion strategy is to create value and comparative advantages of the product in the consumer's mind. Therefore, the primary communication objective is informative to reach a wide audience of customers, aiming to form the consumer's initial perception of the product and its key benefits. Intensive and informative communication can make this possible. Accordingly, the following promotion tools can be used:

- advertising: focusing on highlighting the product's features and benefits that align with the goals of sustainable development, societal eco-trends, conscious consumption, and being beneficial for consumer health;
- public relations: aimed at shaping the product's image as one that aligns with sustainable development objectives, eco-friendly trends, conscious consumption, and being beneficial for consumer health.

Strategies for penetrating foreign markets with innovative product and marketing strategies in modern conditions should align with the global sustainable development goals for the period up to 2030, established by the United Nations in 2015 and reaffirmed through its resolution. These goals serve as the main guide for the development of all sectors of the economy. The production of the researched innovative product is based on the use of plant-based ingredients that are part of climate-friendly food technologies. Therefore, it can be concluded that this allows for the realization of the following sustainable development goals of humanity:

- Goal 2 of sustainable development: overcoming hunger and promoting agriculture, as it produces new innovative technologies for the development of the food industry.

- Goal 3 of sustainable development: ensuring good health and well-being, which is directly related to the development of two sectors: medicine and the food industry.
- Goal 13: mitigating the consequences of climate change through the use of modern technologies that are less harmful in terms of emissions and climate preservation.

5 Conclusions

Developing an effective promotion strategy for innovative products in the international markets requires a thorough examination of their innovative features, the purchasing behavior of the consumer, and the identification of any barriers to their perception. This forms the basis for creating a promotion strategy that can effectively overcome these obstacles. The proposed approach for developing such a strategy involves monitoring the market environment, identifying barriers to the perception of innovation, defining goals for the promotion strategy, planning the strategy and defining the tools for the promotion complex, preparing and distributing the promotion budget, evaluating effects, and assessing effectiveness. This includes forecasting sales and profit growth, and determining whether the target strategic goals and planned indicators have been achieved.

The primary research conducted allowed for the identification of aspects that are important for the development of promotion strategies for innovations in international markets, including key characteristics of innovative products, factors, and peculiarities of consumer motivations, and barriers to innovation adoption. This can be applied in practice across various business domains to select promotion tools and build an effective set of strategic promotion measures.

The directions for further research may focus on specific characteristics of the innovative product and take into account their peculiarities when developing a promotion strategy in international markets. Namely, the values of the innovative product, and the development of measures aimed at conveying these values to the customer. Future research may also focus on exploring sector-specific characteristics of promotion strategies for innovative goods in different economic branches and on different international markets with various cultural contexts.

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Primary Paper Section: A

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CONTINUAL IMPROVEMENT OF THE EDUCATIONAL PROCESS

^aISTVÁN SZÖKÖL, ^bILDIKÓ PŠENÁKOVÁ

^{a,b}Trnava University, Priemyselná 4, 918 43 Trnava, Slovakia
email: ^aistvan.szokol@truni.sk, ^bildiko.psenakova@truni.sk

This article was published due to the project KEGA 012TTU-4/2021 "Integration of the usage of distance learning processes and the creation of electronic teaching materials into the education of future teachers".

Abstract: Schools must keep up with the tempo of rapid technology improvement. Based on the assessment of social changes schools must gain a new form of education. This new form of teaching should be considering how people learn, and how they effectively use the technology of 21st century. Students, who come to university, have abilities and knowledge about Information and Communication Technology, however the standards are different on every type of secondary schools. That's why universities must accept new conditions and teach the knowledge, which they don't possess. The goal of this work is to demonstrate the importance of information and communication technologies in the process of education as one of the most important tools enhancing the quality of tuition. The aim of education will shift to improve the skill of learning, critical thinking of the learner, improve the ability to communicate and work with information and communication technologies as well as gathering, analyzing and using information effectively and efficiently. Information literacy competency extends learning beyond formal classroom settings. Different forms of media and electronic sources of information will gain broader space

Keywords: Key competences, standards, activating methods, information literacy

1 Introduction

Nowadays quality is a dominant feature in every aspect of life. After joining the European Union, quality should be based on needs and requirements of the European Union regarding quality assurance.

The primary purpose of each school should be created based upon the requests of the labor market not based on teachers experience and intuition. It needs regular feedback (students' attitude toward learning, school, assessment of students' talent and ability). One way to increase the quality of education is to develop the system of quality management at secondary schools according to ISO 9000 standard and the TQM (Total Quality Management) philosophy. Emphasis should be placed on the quality of educational process, so that the graduates would be prepared and meet the requirements of their future employers' expectations.

2 Standards

In the most of countries in the world there is a national trend to create the requirements on the work results of schools, so-called Standards, that are regularly monitored. The most of products are required to meet a predetermined standard whereby meeting of the requirements are strictly controlled. However, it has not been provided in educational system. Nobody has basically guaranteed that the graduate has mastered the required knowledge, skills, attitudes etc. The idea of Standards in education has begun to be promoted during the last few decades according to the example of the industry (Bendíková, 2020).

The term "Standard" means the degree of perfection required for a particular purpose or accepted for preapproved model (pattern, standard, rate) by which the real objects and processes of the same category are being compared or measured. The Standards are therefore required and binding characteristics of quantitative or qualitative properties of a particular object or phenomenon.

Nowadays, multiple kinds of standards are currently discussed in the educational system. For example, the pedagogical literature distinguishes these types of standards in the United States (National Standards for Civics and Government. Draft for Review and Comment. Center for Civic Education. Calabas 1994): Students' Standards have dual form: content and performance. Content Standards are requirements that define what students should know or can do.

The content and scope of the different subjects are defined by the curriculum. The subject matter is represented mainly by appointing the knowledge to be made available to students. In the context of rapid scientific and technological development an explosion of information has begun, thus resulting in an overdimension of the curriculum. The overdimension can also be caused by the fact that the allocated number of teaching hours for the teaching of certain subjects it was reduced whereby the curriculum content remained essentially unchanged. The only way to remove overdimension of school curriculum is to reduce the effort to teach the maximum amount of information, i.e., to determine basic teaching material.

Performance Standards are detailed elaboration of the Content Standards and contain the level of achievement that is expected of them. There are three levels of achievement standards: basic, intermediate, and advanced. They are also called target standards.

Teachers' Standards: They essentially contain the detailed qualification requirements for teachers to help students accomplish the performance standards.

Schools' Standards: They include criteria for schools. Their fulfillment is to ensure an equal opportunity for all students to achieve the content and performance standards.

State and Local School Authorities' Standards: They contain criteria to assess the success of the state and local school authorities in fulfilling their mission in education.

Performance and Content standards form the Educational Standards. Each Content Standard should be determined by elaborated Performance Standards and vice versa. Both standards correspond to each other.

Evaluation Standards: They are an essential building block in the development of educational programs. Evaluation Standards define the set of criteria, organizational and methodological procedures for verifying the achievement of learning outcomes or professional competences. In relation to the acquisition of qualifications they must be based on qualification standards (Hrmo, Turek, 2003).

Evaluation standard includes:

- a) evaluation criteria for each general and professional competence. They determine how to establish the evidence that learning has been completed and demonstrated for the required competence. They must be linked to learning outcomes. Since the competences determine what a person must know and perform within a given qualification or employment, the criteria determine whether these competencies are acquired. The criteria must be specific, clear, objective, and relevant in relation to the particular competence. They must relate to only one competence.
- b) the means and methods of evaluation - defining ways and means of verification of particular competences
- c) organizational and methodical guidelines - for the course of tests. These are the different rules and regulations for final exams and school leaving examination which are part of the valid legislation (Marks, Lajčin, 2017).

3 Quality of education

In the field of education quality may be understood as a normative category, which may be expressed by the following indicators: quality of educational processes, quality of educational institutions, the quality of the educational system It can be prescribed to certain conditions (e.g., educational standards), and therefore be objectively measured and evaluated (Hrmo, Podaril, 2013).

Another tool which affects the quality of education are media. With the help of the media, it is possible to achieve a better efficiency of the teaching process and a higher language

progress of the student only thanks to good didactic management and planning. (Godiš, 2022)

Factors determining the quality of education:

- The curriculum,
- Teaching methods, procedures and means implemented in the educational process,
- Forms of knowledge verification,
- The independent creative activities of students and their involvement in research,
- Internationalization of education,
- Personal, spatial, and informational assurance of the educational process,
- Securing the study literature for subjects of the study, and more (Kaščák, Pupala, 2007)

Using the concepts quality and efficiency are indeed very frequent, but often, without a clearer definition. Especially with the introduction of globalization, the concept of quality occurs in virtually all areas of human activities, including education. Education is a service provided by an educational institution. First and foremost, it is important to note to whom this service is intended and what its purpose is. Furthermore, it is imperative to understand that learning cannot be clearly considered from an economic standpoint. The level – quality of education may be evaluated, but more subjectively, qualitatively than objectively and measurably, continuously, and long term. The specific of higher education is its 'optional nature (Marks, Lajčin, 2016).

In education the term quality (quality management) refers to several elements, for example:

- The educational system: the basis is the quality of the country's (region's) educational system, its goals, philosophy, educational content, the structure of the educational system, principles of management and financing of education, incorporation of children, youths and adults into the educational system, the ability to achieve qualification, flexibility, and openness of the educational system. To increase the quality of the educational system in a certain country, international comparability of its performance is needed through international surveys, such as PISA, TIMSS etc.
- School (school facility): We explained above that the degree of quality is the key to survival (existence) of schools. Each school ought to develop its own quality management system, which would apply to all ongoing school processes and furthermore would include all school staff as well.
- Teaching process: The teaching process is the most important of all processes at school and therefore its quality is a crucial element for the quality of schools. The quality of the teaching process in the subjects they teach can also increase the teacher individually (group of teachers) if the school has still not implemented quality management.
- Learning of pupils and students: The quality of learning of pupils and students is the culmination of efforts to increase the quality of education. The aim should be to make pupils, students acquire rational ways of learning - learning competences, to be aware of their preferred learning style and implement it, as well as metacognition and also metalearning to implement an in-depth approach to learning. The result should be a strategically focused student, someone, who wants to take the responsibility for their learning management, is able to manage his own learning and is able to optimize his learning process in school, out of school and after school years. Such pupils and students have the greatest chances of success in the current, constantly and rapidly changing world, because they will be more successful in lifelong learning (Kissné Zsámboki, 2021).

3.1 Quality of the Educational Process

The concept of TQM, even though it is based on industrial management processes, is also applicable in the field of

education, and it only requires a certain degree of adaptation. Among the most common management systems focused on quality management in Europe is the ISO 9000. The possibility of application of this standard in education is limited because it has been developed for manufacturing processes in electronics and engineering. EFQM model is also applicable in terms of education, however in the afore mentioned model the emphasis is mostly on internal assessment of the organization. TQM is primarily a philosophy which aims to ensure quality. Quality models based on the philosophy of TQM are concentrated on the human resources as the main bearer of quality and value (Marks, Lajčin, 2017).

Based on the TQM model, the following four elements are the most important features of the quality of the educational process (Pavlov, 2018):

- focus on customer satisfaction,
 - focus on the learning process,
 - continual improvement of the educational process,
 - creation of a suitable climate for teaching.
- Focus on Customer Satisfaction

The quality of teaching process is based mainly on the achievement of the teaching goals, meeting the educational standards and requirements of third parties, particularly the achievement of student and parent satisfaction. At the beginning of the school year the teacher should find out through an anonymous questionnaire or interview, how and what students want to be taught: what methods, forms, and material resources they prefer, what should be the relationship like between teacher and students, what climate should be in the classroom, which topics of the curricula they are interested in the most, and so on. As often as possible during the school year (preferably at the end of each teaching unit) the teacher should give students a short questionnaire for the assessment of the teaching unit. From time to time the teacher should have a short chat with students on „What do you suggest to improve the quality of my classes.“ Students should fill out an anonymous questionnaire for the assessment of teaching at least once each semester, which includes an assessment of personality of the teacher. (Bendíková, 2014).

- Focus on the Teaching Process

If unsatisfactory results of teaching are found first and only after that the correction are made, it is usually too late. It is much more effective to prevent shortcomings than to correct them additionally. Therefore, in TQM and also in other quality management systems the focus on the quality of the teaching process is advised. Teachers should be familiar with the latest information, trends, innovations in pedagogy, psychology, methods of teaching of particular subjects and other scientific disciplines, and of course in content of subjects they teach and apply these innovations in education. This requires systematic and regular further training of teachers, their professional and career development. (Pavlov, 2018).

Teachers should have access to the latest information; thus, they should ensure to have enough literature and magazines. It is necessary to remove overdimensioned curriculum and determine what the basic curriculum is for subjects because less is usually more. It is necessary to respect the cross-curricular and interdisciplinary approach. (Porubčanová, 2018) In the learning process it is necessary to apply humanistic approaches towards students, because humanistic education is based on trust in the abilities of the students, their self-realization and creativity.

- Continual Improvement of the Educational Process

To improve the teaching process teachers should constantly think, analyse, and evaluate their own work and try to improve it. An essential part of their work should be a systematic approach called PDCA (plan-do-check-act) cycle.

The aim of the continual improvement of certain steps and activities is a good and reliable process, because if all the steps and activities are carried out properly, then it is assumed that the entire process will meet the expectations of customers. If a service (eg. learning process) does not meet the expectations of partners, despite well-performed steps and activities, then there is nothing else left but to schedule a new process (Szókö, 2016). An essential part of the teacher's work should be a systematic approach called PDCA cycle (Pavlov, 2018). This cycle consists of four stages:

1. Planning activities which are essential for education improvement.
2. Realization of the plan.
3. Evaluation of the realized plan with adequate methods.
4. Analysis of the results during the creation of new plan. (Turek, 2014)

An important aspect of the PDCA cycle is the integration of newly tested and proven methods into the standard course. This integration must happen after the innovation test.

- Creating favorable climate in teaching

The classroom climate is the atmosphere and mood that prevails in the classroom. According to Kissné Zsámboki (2021) the concept of climate means typical human relationship, the modes of interrelated communication, that influence participants' feelings and intuitions.

The classroom climate significantly influences students' motivation. In successful schools, teachers are interested in their own subjects. The climate is demanding which means that the teachers require the best from their students, and the students can achieve that. Students are dominantly taught in this demanding way, because the teachers expect that the results of students will become better (so called Pygmalion effect). Newer researches imply that this effect is overestimated. (Raudenbush 1984). Still a lot of teachers believe in it. It is important that the teacher creates conditions to raise motivation (with the help of suitable education materials and tools).

In learning process teachers should create an environment in which students would not be scared, nervous or bored. They should allow the student to experience success, support and develop their personality, have expectations which meet the students' individual abilities.

Climate in the classroom is influenced by:

- Communication and teaching methods,
- Students' participation in the classroom,
- Preferential attitudes and teachers' expectations towards students,
- Climate of the school. (Kaščák, Pupala, 2010)

To improve the climate in the classroom is possible through:

- 1) Improve the relationship between pupils: trying to increase the feeling of being part of the same team, organizing events in and out of school. Making use of pair work, group work a eliminate of bullying, aggression, and humiliation in the classroom.
- 2) Increase students' interest in teaching: make teaching more interesting, insert tasks, which show practical use of the curriculum, motivate students to do some work outside the class, help increase the need of students self-determination, self-realization.
- 3) Keep order and calm in the classroom: teaching process can be fun, but it is necessary to prevent intentional interference. (Belz, et al, 2001; Hrmo, et al., 2003)

4 Modular system of education

Quality is the measure of the perfection, preciousness, usefulness of the education and learning, fulfilling of requirement and

expectations of the schools' clients: pupils, students, parents, employees, citizens of the country. Quality of the education can continuously rise without consideration of the actual level.

It is possible to study computer science at the university in a modular way. This means that students can only study those topics that they do not know. Students who apply to IT universities have different knowledge of the given field, as they studied at different high schools according to different standards. The different level of students' knowledge has an impact on the students' further study.

Students entering their first year at university usually do not reach the necessary level of information skills of a senior according to existing standards. The reasons of these differences are different. One of the reasons could be the kind of secondary school or the level of ICT (information and communication technology) education. Furthermore, not every student has the same connection with ICT, hence they have lower motivation. The previously mentioned reasons of student knowledge differences stem from the external factors of education. These external factors encompass the material and technological preparedness of the specific schools and the level of student preparedness. The material and technology tooling of the education is impacted by the financial abilities of the specific subjects. These can be changed in a short timeframe through cooperation with state authorities. The level of student preparedness is not so easy to equalize. It could be possible, that the different knowledge of the students, coming to universities, will be a problem for a long time. One of the solutions for this issue specifically aligned with informatics subject can be the modular system of education.

To ensure sufficient informational knowledge on single education levels, the educational programs contain basic and special subjects oriented for informatics and ICT.

5 Offer for the content and aim of single modules

To avoid redundancy in the education process, and that all students could make connection between the present and previous studies about informatics the modular system of education for this subject was created.

Individual modules have a defined structure: introduction, objective, content, and effect standard, learning material, summary, self-test, conclusion, supplementary literature, and bibliographic references.

The modular system of education contains 5 modules. These 5 modules are taught during two semesters. The first 3 modules are available in first/winter semester and the last 2 modules are available on second/summer semester. These modules contain approximately 20 hours of classes. Altogether the modules contain 104 hours. At the beginning of the first semester the students have to pass an entering test and based on the outputs they sign up for the specific module.

Educational support of modules is divided and structured with the goal to make the teaching of the participants maximally effective. The effectivity is primarily in that the participant can concentrate on the content of learning, because the study text contains element which accelerates auto regulation. After the sign up to the subject (course) the participants get the study material.

The input diagnostics of the module: lector with the help of diagnostic dialog and cloak test evaluate the knowledge and ability of the student. If it is needed, the lector defines individual tasks which the participant of the course solves and send back to the lector in electronic form for evaluation. This method provides the lector with enough information to find out if the successfully absolved the course.

6 Type of testing

The type of testing where students are allowed to use any literature and aids (open-book exam) is also widespread. Such testing is focused mainly on higher cognitive processes such as analytical or critical, creative thinking, the ability to solve problems, the ability to acquire and use information, etc.

At present, authentic learning and the authentic evaluation of students is a very current trend. The teacher organizes the teaching process in a way so that it could be comparable to the real world and life as much as possible and students could apply the subject matter of instruction meaningfully, for example creating something that brings joy to themselves, their parents, friends, or other loved ones. With authentic evaluation the artificial school task is not assessed (e.g., the exercises of an achievement test), only the student's performance, which is meaningful even outside teaching, out of the school. For example, it is not enough if the student describes the general phenomena of the electromagnetic field, but he is able to design an operating front doorbell. With authentic evaluation it is not sufficient that students merely reproduce the curriculum, but on the contrary, they must search for information, interpret them, analyze, produce, create, explore, and solve problems related to the subject (Porubčanová, 2018).

The students could also be involved as partners in the evaluation process. For example, they can correct and assess educational tests themselves according to predetermined criteria which can be formed with their and the teacher's involvement. Such a procedure has an educational impact as well, forming various character traits of students, such as honesty, fairness and persistence. It is also appropriate from time to time to carry out a discussion with students focused on testing, evaluation and marking. One of the current trends is also students' self-assessment and their assessment of other students, called peer evaluation. Both of these evaluations are taken into account in the final evaluation. For example, a student will first evaluate his response alone (essay, oral report etc.) then it is assessed by his classmates and eventually by the teacher who compares and considers the student's self-evaluation, his/her own and the evaluation of classmates. Students thus learn to evaluate themselves, to value other people, objects, processes and the phenomena of the surrounding world and to receive and reflect on the evaluation of their person from others.

The formative evaluation of students is advised to use in a much greater extent. The aim of formative evaluation is feedback, acquiring information on how students learn, detecting and diagnosing weaknesses, mistakes, difficulties and their causes in the process of learning in order to eliminate them and make students' learning activities more efficient. For the teacher, feedback helps to choose the optimal teaching practices. Formative assessment was not used to be associated with the marking of students. Formative assessment is often identified with students' continuous testing and evaluation. This is a mistake because in continuous evaluation the subject matter of one or more lessons is assessed, the causes of deficiencies are not detected and the student is not usually informed of these deficiencies, nor on how to eliminate them and make the learning process more efficient (Zapletal, ez all, 2022).

Verbal evaluation of students is also widely used complementing the marking process or even replacing it. It is very difficult to assess students' attitudes, interests, their value system, talents, skills and core competences with a mark. The biggest disadvantage of verbal evaluation is that words can be ambiguous. Verbal evaluation is more laborious than the evaluation with a number, as the teacher must invent a verbal assessment for each student, plus pay attention to avoiding its repetition. Therefore, the tendency is to combine number-based evaluation with verbal evaluation. Verbal evaluation should include in particular:

- the student's interests, special skills, talents,
- the quality of the achieved results,

- moral and personal characteristics, diligence and conscientiousness,
- activity and independence,
- the understanding of spiritual values,
- the level of the student's key competences (how he can study independently and rationally, what his relationship is to learning, the ability to solve appropriate problem tasks, the level of critical and creative thinking, communication skills, personal and interpersonal competences, e.g. the willingness to help others, respect, courtesy),
- the level of knowledge and skills of the student,
- behaviour, respect for educational and social requirements,
- aesthetic expressions and aesthetic sense,
- the protection of material values (Zapletal, Hanuliaková, 2015).

In vocational training there is a tendency for testing and focusing evaluation on acquiring the relevant professional and key competences, and achieving the appropriate standards. Evaluation is often external. Not only teachers evaluate students, but vice versa, students also assess the quality of teachers' work through anonymous questionnaires. The humanization of students' evaluation is based mainly on trending towards the progress in their development, detecting and evaluating changes in their attitude, skills and knowledge, compared to a previous state, and the students themselves at the time. It is thus about the individualization of the student's evaluation. Comparing the student's performance with the standard is subordinate here and is implemented through tests to verify the achievement of the required educational standards. The aim of the humanistic-oriented evaluation of students is to develop their self-assessment skills (Lajčín, Porubčanová, 2021).

In our research paper we conducted a cloak test in the first semester of ICT classes. We want to analyse the success rate of students in modular system of education. This analysis was conducted for number of informatics hours optimization. By making the modules not required for the people able to pass the tests we expected that the overall number of informatics hours will drop down significantly.

7 Results of the experiment

The number of students, who have worked out the cloak test in the first semester, was 181. Students must reach minimally 60% on the test, to finish the module.

Total claim of students on the faculty - first year

Table no. 1 Result of the formula in the first class

Modules	Above 60%	Below 60%
Module 1	107	74
Module 2	99	82
Module 3	52	132
Module 4	20	161
Module 5	0	181

Those who were able to pass the cloak tests were not made to take the informatics hours. Hence the overall number of hours dropped.

Table no. 2 Number of needed groups in weeks in the first semester

Weeks	1-5	6-9	10-14
Need	74	82	132
Don't need	107	99	52
Number of groups in week	3	3	5

Without our modular system 6 group were expected to be created for the informatics hours. That would make 336 hours of informatics per semester. From the table no. 2 we can conclude that the number of groups differed during the first semester from the expected value. For the first 9 weeks only 3 groups were made and for the last five weeks 5 groups were created. Therefore only 208 hours of informatics were held. These

altogether concluded in an overall change of -38% in hours. The final exam from the informatics class had to be made by all students even if they have not participated in specific modules of the subject.

8 Conclusion

In today's society, the use of various forms of information and communication technologies as well as working with information is a daily activity. The amount of information available to humanity is growing at an enormous rate, therefore it is important to know how to search for it, select it, sort it, process it, assess its relevance, and use it. Hence it is necessary that foremost the university-educated people are information literate.

Although informatics is taught in secondary schools, not all students come to university with sufficient knowledge and skills in this area. It remains the task of universities to ensure that during their studies the students acquire the level of knowledge in this field required by society, as well as adequate skills in controlling computer equipment.

However, the school's capacities are often limited, both in terms of the number of computer laboratories and the number of teachers. Therefore, we tried to find a way to limit the number of teaching hours. The presented module system made it possible to reduce the number of teaching hours, while the success rate of passing the course improved. The system is acceptable for both students and teachers. Students don't have to be bored in classes whose content they have mastered and have more time to devote to new parts of the content. On the other hand, educators can focus on students with weaker knowledge of the given area to achieve the necessary level of knowledge.

We know that schools must keep up with the rapid progress of technology and be part of social changes. It is necessary for an educated person to know what processes are taking place in a given society, what events are happening in it, in order to be prepared for the changes that development brings. Knowing the society, we live in is important not only for future teachers who will prepare the new generation for life in the information society, but also for economists and managers who will manage this society. Only schools that use new forms of education based on the results of pedagogical research and effectively use modern technologies of the 21st century can prepare them for this.

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Primary Paper Section: A

Secondary Paper Section: AM

DECISIONS FACTORS OF SIMULATION GAME PLAYERS ON THE PRODUCT MIX COMPOSITION

^aPAVEL ROUSEK, ^bVOJTĚCH STEHEL

*Institute of Technology and Business in České Budějovice,
Okružní 517/10, 370 01 České Budějovice, Czech Republic
email: ^arousek@mail.vstecb.cz, ^bstehel@mail.vstecb.cz*

Abstract: This paper analyses the behavior of players of a simulation game in the context of the composition of the product portfolio, the number of material ingredients and the necessary initial investments. The aim of the study is to provide knowledge for managers and entrepreneurs in optimizing investment strategies to achieve maximum results. The results show that investments in know-how have an impact on overall production and sales success, with higher investments associated with lower production and a higher percentage of successful sales. This study provides important insights for strategic decisions regarding the optimal allocation of resources and the use of know-how, with the aim of achieving competitive advantage and high results in the market.

Keywords: Simulation Game, Material Ingredients, Initial Investment, Production Size, Sales Percentage.

1 Introduction

This paper focuses on the analysis of the behavior of players of the simulation game, on finding out the causes of their decisions about the composition of the product portfolio, on the influence of various product parameters, the influence of the number of ingredients, the influence of the necessary initial investments. Previous studies have shown the positive effect of simulation games on managerial skills and managerial efficiency (Smutny et al., 2016). The findings reached in this paper extend the existing valuable knowledge for managers and entrepreneurs who strive to optimize their investment strategy and achieve maximum results.

The results of this study may have an impact on strategic decision-making in the corporate environment. Managers and entrepreneurs should consider the optimal allocation of their investment resources between increasing production and investing in know-how. Previous research reveals investing in know-how as a path to Industry 4.0 (Zangiacomi et al., 2020). By rationalizing production, reducing material requirements and lean production, the enterprise can achieve personnel savings (Shenshinov et al., 2020). The combination of these two factors can lead to optimal results and competitive advantage in the market.

2 Simulation Game

The game is a simulation of a market environment in which the player takes on the role of a manager of a manufacturing enterprise focused on the production of soft drinks. The main goal of the game is to establish and run a viable company that achieves positive economic results and generates Economic Value Added (EVA). The EVA indicator is measured as the product of net operating profit (NOPAT) and cost of capital ($C \times WACC$). The EVA indicator was chosen because it allows the evaluation of the sustainability of a company (Jankalová & Kurotová, 2020). A key factor in achieving positive economic value is to achieve a higher return on capital than the alternative cost of capital.

The production process is a mix of inputs:

- **Material:** The manufacturing process requires a supply of materials. The player must always decide when and how much material to order if needed. Delivery times of material are one month. Individual types of products differ from each other by the material consumption of individual material items.
- **Employees in production and administration:** The player can decide to hire and fire production employees if necessary. Employees hired in each round are immediately available and their costs must be covered immediately.

There are six categories of employees in production created with different levels of work performance and wage rates. Employees' work performance reflects their time efficiency but never reaches 100% due to absences caused, for example, by vacation or illness. Production workers without administrative support are not productive and still must cover associated costs, such as wages.

- **Machines:** The maximum production capacity of one filling line for a given product type is limited. There are three levels of the filling line – chaotic, disordered and ordered – and moving to the next level requires investment in the production process. It is important to note that production workers without adequate equipment are not productive, although the wages associated with them still must be paid.
- **Production and storage facilities:** The player has the option to decide to increase or decrease the production facilities if necessary. The labor and capital factors of production occupy a certain production space, which can be increased until capacity is filled. Materials and products occupy a certain storage space, and their quantities can be combined until the capacity is filled.

All inputs represent costs for the virtual business.

The key production factor is the production staff, according to whom the production capacity is managed. Exceptions are situations where employees in production do not have administrative support, capital support, or material support. This is a parameter where the simulation game exactly corresponds to the current reality and the near future in the environment of Industry 4.0 (Sgarbossa et al., 2020).

As part of the simulation game, the company can produce a portfolio of up to five soft drinks:

1. Soda water is a mix of 3 types of material and its introduction into production does not require any investment in know-how.
2. Lemonade is a mix of 4 types of material and its introduction into production does not require any investment in know-how.
3. Fruit drink is a mix of 4 types of material and its introduction into production requires a lower investment in know-how.
4. Juice is a mix of 3 types of material and its introduction into production requires a lower investment in know-how.
5. Energy drink is a mix of 6 types of material and its introduction into production requires a higher investment in know-how.

3 Player Behavior

3.1 Total Sales According to the Complexity of the Production Process, i.e., the Number of Inputs

The production portfolio of soda water, lemonade, fruit drink, juice and energy drink can be segmented into groups according to the number of ingredients and then monitor the players' decisions on the volume of production.

Products with 3 ingredients

- Total soda water sales: 7,034,131 pcs.
- Total juice sales: 4,880,131 pcs.

Products with 4 ingredients

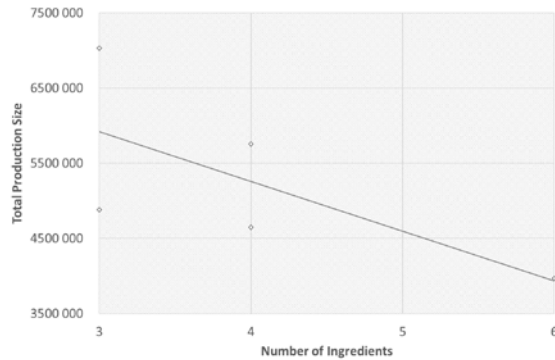
- Total lemonade sales: 5,753,907 pcs.
- Total sales of fruit drinks: 4,647,629 pcs.

Product with 6 ingredients

- Total sales of energy drinks: 3,970,620 pcs.

If the total production size is compared depending on the number of ingredients, the values shown in Figure 1 are found:

Fig. 1: Dependence of the Size of Production on the Number of Ingredients



Source: Authors

The number of products produced decreases by an average of 662,170 pieces with each additional ingredient. This conclusion shows a value of R-squared $R^2 = 0.472$ and a Pearson correlation coefficient $r = -0.68705$, which corresponds to a strong negative relationship.

3.2. Total Sales According to the Complexity of Commissioning, i.e., Investment in Know-how

The production portfolio can be segmented into groups according to the amount of necessary initial investments and subsequently monitor the players' decisions on the volume of production.

Products with no investment required.

- Total soda water sales: 7,034,131 pcs.
- Total lemonade sales: 5,753,907 pcs.

Products with a lower investment required.

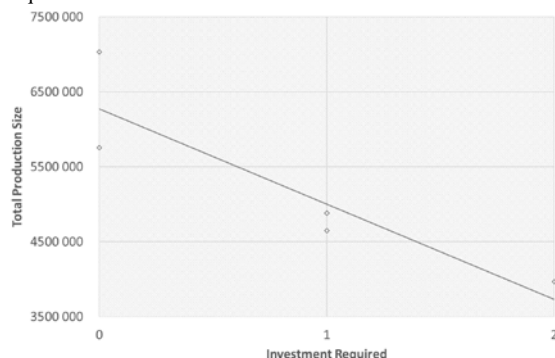
- Total sales of fruit drinks: 4,647,629 pcs.
- Total juice sales: 4,880,131 pcs.

Products with a higher investment required.

- Total sales of energy drinks: 3,970,620 pcs.

If the total production is compared with the necessary input investment for commissioning, the values shown in Figure 2 are found:

Fig. 2: Dependence of the Size of Production on the Investment Required



Source: Authors

The number of products produced decreases by an average of more than 1 million units with each additional stage of investment. This conclusion shows a value of R-squared

$R^2 = 0.8122$ and a Pearson correlation coefficient $r = -0.90122$, which corresponds to a very strong negative relationship.

3.3 Percentage Sales According to the Complexity of the Production Process, i.e., the Number of Inputs

The production portfolio can be segmented into groups according to the number of ingredients and then monitor the success of sales.

Products with 3 ingredients

- Percentage sales of soda water: 93% of production sold.
- Percentage of juice sales: 96% of production sold.

Products with 4 ingredients

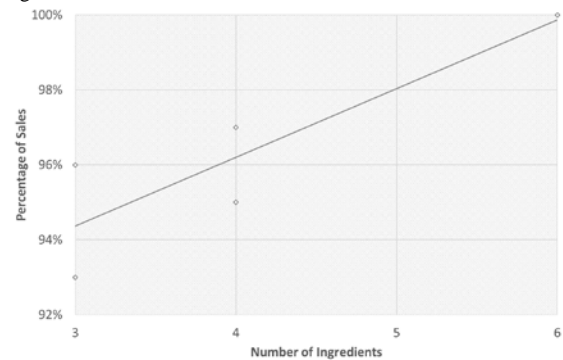
- Percentage of lemonade sales: 95% of production sold.
- Percentage sales of fruit drinks: 97% of production sold.

Products with 6 ingredients

- Percentage sales of energy drinks: 100% of production sold.

If the treatment, non-utilization, or sale of production is compared depending on the number of ingredients, the values shown in Figure 3 are found:

Fig. 3: Dependence of Sales Success on the Number of Ingredients



Source: Authors

The probability of selling increases by an average of 1.83 percentage points with each additional ingredient. This conclusion shows a value of R-squared $R^2 = 0.7525$ and a Pearson correlation coefficient $r = 0.86746$, which corresponds to a very strong positive relationship.

3.4. Percentage Sales According to the Complexity of Commissioning, i.e., Investment in Know-how

The production portfolio can be segmented into groups according to the amount of necessary initial investments and subsequently monitor the success of sales.

Products with no investment required.

- Percentage sales of soda water: 93% of production sold.
- Percentage of lemonade sales: 95% of production sold.

Products with a lower investment required.

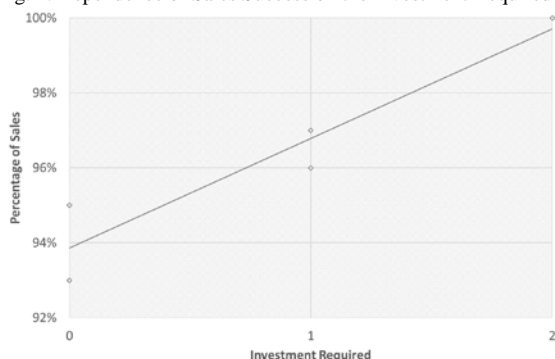
- Percentage sales of fruit drinks: 97% of production sold.
- Percentage of juice sales: 96% of production sold.

Products with a higher investment required.

- Percentage sales of energy drinks: 100% of production sold.

If the treatment, non-utilization, or sale of production is compared, depending on the input investment needed for putting into production, the values shown in Figure 4 are found:

Fig. 4: Dependence of Sales Success on the Investment Required



Source: Authors

The probability of a sale increases by an average of 2.93 percentage points with each additional investment step. This conclusion shows a value of R-squared $R^2 = 0.8961$ and a Pearson correlation coefficient $r = 0.946602$, which corresponds to a very strong positive relationship.

4 Conclusion

The investment required has the greatest impact on total production. These conclusions coincide with real-world research, both in the agricultural sector (Gavrilova & Fedorova, 2020) and in the industrial sector (Borisov & Pochukaeva, 2019). In a simulation game, the higher the need for investment in know-how, the lower the production of the product. The initial investment has the potential to discourage potential producers. Each additional stage of investment reduces production by more than a million pieces of finished products ($r = -0.90122$).

The success of the sale of the overall production is also influenced by the required investments. Also, these conclusions are consistent with empirical research on the real environment (Khidirov, 2023). The simulation game shows the results that the higher the need for investment in know-how, the higher the percentage of products successfully sold. If a player must try to achieve a result, he appreciates this result more and does not allow inefficiencies. Specifically, each additional investment level increases sales success by 2.93 percentage points ($r = 0.946602$).

The number of ingredients in the final product is not such a significant factor in this regard. A higher number of ingredients reduces the volume of production and increases the percentage of success of sales, but these dependencies do not have such a strong effect as was observed in the case of the required initial investment in know-how.

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Primary Paper Section: A

Secondary Paper Section: AH

SCOPE AND METHODOLOGICAL CORRECTNESS OF USING THE BALANCED SCORECARD METHOD FOR MANAGEMENT PERFORMANCE-BASED COMPENSATION IN MID-SIZE CZECH COMPANIES: A QUALITATIVE SURVEY

^aJAN URBAN, ^bMICHAL RUSCHAK, ^cBLANKA BOROVKOVÁ

^{a,c}*Faculty of Corporate Strategy, Institute of Technology and Business in České Budějovice,*

Okružní 517/10, 370 01 České Budějovice Czech Republic

^b*Pan-European University, College of Entrepreneurship and Law, Praha, Czech Republic*

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Abstract: Performance remuneration of managers using the balanced scorecard (BSC) method has two main advantages. The first is the motivational criteria derived directly corporate strategy, the second is the "balanced" nature of remuneration based on other performance targets in addition to "traditional" financial indicators. However, the prerequisite for the effectiveness of this method is its correct use, which assumes that the essence of the method and the individual components of its methodology are correctly understood and applied. The article deals with the extent of occurrence of this method as a tool for performance remuneration in Czech companies, and the extent to which its practical application corresponds to its methodological assumptions and requirements. The paper uses a qualitative survey carried out in mid-size and large enterprises in the Czech Republic to determine to what extent the prevailing way in which the method is used can be regarded as a tool increasing the value added of performance-based management compensation, what are the basic prerequisites for an effective use of this method, and what main modifications/adaptations leading to its higher effectiveness the method allows without losing its rationale.

Keywords: Corporate strategy, Management compensation, Balanced Scorecard Method, HR management, Promoting the effectiveness of Management Compensation

1 Introduction

The BSC method (Kaplan, 2012; Kaplan & McMillan, 2020; Kaplan & Norton, 2007a) was created as a tool for better/unbiased measurement of corporate performance, a clear expression (and better understanding) of the company's goals, coordination of the goals of individual organizational units, and thus better enforcement of the company's strategy (Bochenek, 2019; Zandieh et al., 2020). Last but not least it is a method of involving managers in meeting the goals that follow from the corporate strategy. BSC has also been selected by the editors of Harvard Business Review as one of the most influential business ideas of the past 75 years (Kaplan & Norton, 2007b). Its advantage is it can be used in very different environments in both private and public sectors (Zawawi et al., 2020; Zorek, 2020,).

The starting point of the BSC method is a clear idea of the corporate strategy (Sharma & Sharma, 2020). Another prerequisite is its conversion into operational performance indicators, not only for the company as a whole, but also for its organizational units or jobs (Dudic, et al., 2020). It can also include the determination of activities (actions, projects), on the basis of which the company or its department of its strategic plans, or performance indicators will be reached (Kurniawan, et al., 2021).

The strategic intentions of the company and its units as well as their corresponding indicators are expressed within the framework of the BSC method on the basis of four performance perspectives. These include a financial perspective and three non-financial perspectives referred to as "customer", "internal processes" and "learning or personal growth of employees". The strategic plans and their indicators established within these perspectives for individual departments and/or job jobs are in principle different and correspond to their nature, management level as well as authorities (Karun Kumar & Kesava Rao, 2020, Lee et al., 2021).

The main difference between the BSC method and other multi-criteria remuneration systems lies in the expansion of traditional financial performance indicators by non-financial criteria (Bajnai

& Popovics, 2020). Financial indicators used as performance criteria and performance remuneration tools do not always give managers the right signals when it comes to the long-term development of the company, but also quality and innovation. The main role of non-financial perspectives is to limit short-sighted financial orientation in the management of the company and to focus the motivation of its managers on indicators supporting the long-term success of the company (Kaplan & Norton, 2007a).

The involvement of non-financial performance perspectives means that performance planning and evaluation focuses not only on results (indicators evaluating the company's past financial performance), but also on the means or prerequisites for the future or long-term success of the company, such as the loyalty and satisfaction of corporate customers, innovation and improvement internal processes or the development of the qualification level of employees. Some of the non-financial indicators have the nature of a "lever" in relation to financial indicators, which allows them to better control these indicators, or to take the necessary steps to achieve them in time (Abedian et al., 2021).

The strategic intention of the company within the financial perspective (corresponding to the interests of the company owners) can be, for example, an increase in the profitability of resources, corresponding indicators of the profitability of assets or investments. However, depending on the stage of the company's development, it may also be about other plans, or criteria, for example, turnover growth rate (for a company that is in the growth stage) or, conversely, cash-flow (for a company in the "harvest" stage and whose goal is cash and a reduction in capital requirements).

The purpose of the customer perspective is to motivate managers or other employees to better satisfy the needs of customers and increase their loyalty to the company, without which the goals of the financial perspective cannot be achieved in the long term. The goals of the customer perspective usually relate to four areas important to customers, namely the time (speed) of production delivery, its quality, product or service innovations and costs, respectively. cost of production (Asiaei & Bontis, 2019).

A strategic intention corresponding to the customer perspective can be, for example, to satisfy customer requirements above the level of the competition, to focus on new market segments or to create partnerships with key customers (Sanchez-Marquez et al., 2020). Corresponding indicators can be compliance with customer service standards, the proportion of complaints, the development of sales from new segments or the number of newly concluded partnerships with customers (Kaplan, 2012).

The perspective of internal processes refers to the effectiveness of internal business procedures, especially those that are decisive for satisfying the needs of the company's owners and customers (and on which the company should therefore focus its attention). The strategic intentions of this perspective can be, for example, increasing productivity, improving quality, shortening lead times, etc., corresponding indicators of work productivity, the number of internal complaints, shortening process time, etc.

A learning and growth perspective reflects the personnel prerequisites necessary to improve business processes. Most of the indicators of this perspective are therefore related to the capabilities of managers and employees, for example the acquisition of new capabilities, improvement or change of existing procedures, etc. (Chopra & Gupta, 2019, Hitka et al., 2021, Caha & Ruschak, 2017).

2 Literature research

The successful use of the BSC method presupposes compliance with its basic performance perspectives (Aryani & Setiawan, 2020). However, this does not mean that these perspectives cannot be in specific cases slightly modified in a way that corresponds to the nature of the company and its goals (De Freitas et al., 2021). However, the number and importance of perspectives should not change too much (Benková et al., 2020).

An example can be a financial institution that, when applying the BSC method, can divide the evaluation perspectives into six perspective groups. These can be, for example, cover the financial, strategy implementation, customer, control, human resources and compliance perspectives (Sarigül & Coşkun, 2021, Sucozhañay et al., 2021). At the top of the organization, its turnover, costs and profit margin indicators can, as indicators, be assigned to the financial perspective, while numbers of customers in individual product segments, numbers of new customers, the amount of managed assets per customer and revenue per customer by individual segment (Khaled & Bani-Ahmad, 2018) could serve as strategy implementation indicators.

The customer perspective can be evaluated using the institution's market share, customer satisfaction with the company's services and service quality, and the control perspective based on the results of regular internal audits and checks on compliance with general legal and internal regulations (Kaplan, 2009).

Perspectives of human resources and compliance with standards can, depending on corporate strategy, be evaluated, for example, based on qualitative (verbal) evaluations of higher managers. The indicators of the human resources perspective can include, among other things, e.g. the level of teamwork, the results of training and development of employees and managers, and employee satisfaction. Adherence to standards can include, for example, evaluation of managers' leadership skills, adherence to ethical principles and customer orientation, etc. (Raval et al., 2019).

Use of the BSC method for performance-based remuneration

The performance indicators of the company, its departments and individual jobs, which the BSC method uses, serve not only as a means of planning, but also as a means of evaluating and rewarding performance (38) which can be used even in turbulent environment (Zandieh et al., 2020). Its use is based on performance remuneration in the form of bonuses based on balanced fulfilment or exceeding indicators, or evaluation criteria within individual performance perspectives (Hussein & Kazem, 2019).

Its introduction as a performance-based remuneration tool therefore presupposes:

- establish appropriate performance criteria and their target values for individual managers or other jobs. In the case of most managerial positions, the set target values will be annual, for business positions, usually quarterly. Targets for individual criteria can be set either in the form of absolute amounts or growth rates, usually compared to the previous year (Kurniawan et al., 2021),
- create a reliable information system that continuously informs employees and their superiors about the fulfilment of performance indicators. A system that provides early warning about potential problems with performance indicators is optimal,
- establish principles of balanced summative assessment. The goal of the BSC method is for the company to achieve good results in all performance perspectives. It is therefore usually necessary to assign certain relative weights to individual indicators. At the same time, however, it is necessary to prevent the non-fulfilment of some indicators from being compensated by the fulfilment of other indicators during the evaluation (Rafiq et al., 2020)

Choice of motivational indicators

The choice of a limited number of indicators characterizing the performance of the company, its departments and positions from the point of view of individual performance perspectives is one of the key questions of the BSC method (Elbanna et al., 2022).

Indicators corresponding to individual perspectives should also be related to each other. They should therefore be chosen to support the goals of the other perspectives. For example, fulfilling the criteria of the learning perspective and personal growth of employees should lead to the improvement of business processes, which should result in higher customer loyalty and, in turn, a higher return on invested capital (Horváth & Gleich, 2022).

The so-called business model of the company can help to set performance indicators correctly, which indicates causal relationships between the main factors or "levers" of business performance (characterized using non-financial indicators) on the one hand (Truong et al., 2020), and expected results (financial indicators) on the other. Ideally, this model should be created before individual performance indicators are selected (Preißner, 2019).

Indicators should also be set so that the fulfilment of goals at lower levels of the organization supports the goals of higher units, or the company as a whole. However, the interconnectedness of the goals set at higher and lower levels of the organization does not mean that the same indicators should also be used at these levels (Ha et al., 2022).

Linking motivational indicators

The basis of the BSC method as a performance-based remuneration tool is to achieve the interest of managers and other employees in the balanced fulfilment of the target values of the company's indicators, i.e., their fulfilment in all performance perspectives. The fulfilment of the motivational criteria used by the method must be summarized in a certain way and in some cases also weighed in a certain way in order to determine the reward. Here, too, occasional problems can be encountered in practice (Panggabean & Jermias, 2020).

The purpose of the BSC method is that managers or other employees can receive their bonus only in a situation where they (at least partially) meet all motivational indicators (Gomes & Romão, 2019), i.e., not only those that are easier to meet in the given situation (Oliveira et al., 2021). In other words, good results in one of the evaluated perspectives, for example, profitability, should not be achieved at the expense of other important indicators, for example, customer satisfaction, related to the assumptions of the successful development of the company in the future (Nørreklit & Falconer, 2007).

If performance pay did not respond to this danger, it could easily lead to a preference for criteria that are given more weight or are easier to achieve, and to neglect criteria that are less relevant to the reward. In summary, this remuneration could motivate in a way that would worsen the company's performance in the long term (Gallo et al., 2018).

The easiest method to prevent an unbalanced assessment is to set the minimum or maximum required values of all criteria. Payment of the reward is then tied to the achievement of the minimum or maximum values of all indicators at the same time. The minimum required values can be, for example, slightly reduced target values of individual indicators.

An example can be the evaluation of the results of individual bank branches, in which the condition for payment of a bonus to their managers is the achievement of a certain minimum level of customer satisfaction. This level can be set, for example, as 75 percent of the level achieved by the most successful affiliate. Similarly, achieving a certain rate of turnover growth or a certain result in the regular internal audit of branches can be used as minimum values to qualify for a bonus (Ferber Pineyrua et al., 2021).

A combination of several evaluation criteria can be used even if the individual criteria are based on the verbal evaluation of direct superiors (as can be the case, especially for "ranking" jobs) (Nair, 2004). In this case, the evaluation results within the individual perspectives are divided into three groups corresponding to "achieving", "exceeding" or "not achieving" the expected goals. These results are then summarized by the superiors, as to whether the overall fulfilment of the criteria in the individual perspectives "exceeds expectations", "meets expectations" or "does not meet them". The results for the individual perspectives are then summarized again in an overall assessment falling into one of the three categories mentioned above (Lee et al., 2021).

The amount of the bonus is then determined differently according to the category into which the summary assessment falls (Mio et al., 2022). The balance of evaluation of individual criteria can be achieved, for example, in such a way that an employee whose aggregate evaluation of criteria within a certain perspective is "below expectations" cannot receive an overall evaluation of "above expectations" (corresponding to the highest bonus), regardless of how as a result, his rating with other perspectives will end (Martini & Suardana, 2019).

Weights of motivational criteria

The weights of individual motivational criteria used in determining the bonus should correspond to the importance of individual indicators for achieving the goals of individual perspectives, or goals of the firm as a whole, and should remain relatively constant (Marzuki et al., 2020). Although financial performance criteria usually receive the highest weight, their relative importance should not be so high that it overshadows other indicators (Estiasih, 2021).

The most frequently used method of weighing individual motivational criteria is based on the fact that performance criteria are assigned percentage weights, the sum of which is equal to one hundred. The absolute amount of remuneration for the fulfilment of individual performance indicators is then in ratios corresponding to the weight of the individual criteria (Marcu, 2020).

A better variant of the mentioned procedure is to weight the individual motivational criteria by assigning them percentages corresponding to the share of the basic salary, which the employee receives as a bonus for fulfilling the given criteria. In this case, the bonus corresponding to the fulfilment of all motivational criteria is given as a percentage of the basic (annual) salary corresponding to the sum of (partial) percentages obtained for individual indicators (Faizova et al., 2020).

In this case, the weights of the individual criteria are determined indirectly – the amount of the percentage of the basic salary that can be obtained as a bonus for meeting the individual criteria (Estiasih, 2021). The advantage of this procedure is the easier possibility to reward managers or other employees even for achieving better than planned results (if this is desirable for the company). In this case, the manager receives an additional bonus for exceeding the performance targets determined again as a percentage of the base salary (Martini & Suardana, 2019). This procedure is usually more suitable especially for business managers, for whom it is not desirable to create a "ceiling" for their performance rewards (Mio et al., 2022).

In line with what we said in the previous section, rewards should always be all-or-nothing. Therefore, if a manager or employee achieves the required values for only some criteria, his remuneration should not be "cut" (by the remuneration attributable to unfulfilled indicators), but he should not be awarded any remuneration. The "consolation price" is contrary to the requirement of balanced fulfilment of the performance indicators of individual perspectives (Marcu, 2020).

3 Methodology and Data

The purpose of the article, based on a qualitative analysis using management questionnaires and semi-structured interviews, mainly with human resource managers of mid-sized and bigger businesses, was to find out to what extent do the companies surveyed use the BSC method as a management performance compensation system, to what extent do they use a multicriterial compensation system inspired by the BSC method, and, in this regard, how successful they are in achieving the goals of their strategy.

More specifically, the research questions covered the following issues:

- (i) do the companies surveyed use the BSC method as a tool of performance-based compensation,
- (ii) do the companies using this method apply it strictly in accordance with its methodology,
- (iii) if the use of the BSC method deviates from its methodological guidelines, what are the main forms/reasons of these deviations and which deviations do not destroy the meaning or sense of the method,
- (iv) how do the surveyed companies, regardless whether they use the BSC method or not, do themselves evaluate (on a scale 1 to 5) their ability to reach, through their compensation system, their business strategy
- (v) how do the companies surveyed, regardless whether they use do the BSC method or not, evaluate (on a scale 1 to 5) themselves their ability to motivate their managers.

Questions obtained in the questionnaires covered both the issue of the BSC method use and the issue to what extent does the alternative and/or modified performance-based compensation system they use contribute to the performance of the company and implementation of its strategy.

Data collection was carried out in the first quarter of 2023, using simple random sampling and the units of sampling were companies operating mainly in Bohemia. A total of 75 companies were included in the research whereby the majority of firms surveyed were either joint-stock corporation or limited liability companies. The number of employees in these companies ranged from 365 to 867 persons, and most of the companies operated in manufacturing, logistics, trade and financial industries.

4 Results and discussion

The analyses of the research questions which followed from the questionnaires answers and interviews statements were the following:

- (i) the percentage of companies surveyed that used the BSC method was less than a half, namely 41percent, and thus not very high (see below)
- (ii) the percentage of companies, out of those that used the BSC method, that strictly applied the original methodology suggested by Kaplan and Norton, was about a half (see below). On a scale 1-5 the company themselves rated (on average) their level of adherence to the original BSC method (1 being strict adherence, 5 a rather lay adherence) as 3,2
- (iii) the main forms/reasons for deviations of the actually used BSC method compared with the original BSC methodology covered the followings:
 - a. a clearly defined company strategy was missing. The BSC method is based on clear corporate goals organized into individual performance perspectives and on the relationships between strategic plans and selected indicators. Without this assumption, the use of the method becomes formal and cannot be very successful. The relative stability of the selected

- indicators should correspond to the strategic nature of the plans in individual perspectives.
- b. too many indicators. Balanced management and performance evaluation cannot be equated with the use of a large number of indicators. A large number of performance criteria dilutes attention to priority goals and creates the danger that the efforts of managers and employees will be directed in the wrong direction. It can also happen that the performance of departments or people will be evaluated positively (because they reached the required value of a number of indicators), although this was not the case for key indicators.
 - c. predominance of indicators relating to the past. The principle of the BSC method consists not only in the use of non-financial indicators, but also in the fact that it includes indicators indicating the company's ability to achieve performance in the future. Therefore, indicators relating to the past development of the company should not predominate among the selected indicators. A similar pitfall can be the tendency to focus performance evaluation in individual perspectives only or preferentially on indicators that are easier to measure. The ease of measuring performance criteria may not be related to their true meaning.
 - d. use of adopted or overly general indicators. Using indicators taken from the practice of other companies is usually not very happy. Each company should try to create its own specific indicators corresponding to its strategy and the possibilities of obtaining competitive advantages.
 - e. the choice of indicators that do not correspond to the nature of the organizational unit or the given level of management. The performance indicators used should not be influenced by factors that are beyond the control of managers, or employees whose work they evaluate. Therefore, it should not be, for example, indicators, the fulfilment of which affects decisions made at a higher management level. An example can be a profit indicator, which is influenced by the prices achieved, which a given, for example, operating unit has no possibility to influence, or an indicator of customer satisfaction, which is mainly influenced by the product characteristics determined by the management of the organization.
- (iv) the success of the companies surveyed to adhere to their strategy through their compensation system was rated (on average) on a 1-5 scale (1 being the best) as 4,2 by companies that used the original form of the BSC method. The same indicators for companies using a modified BSC method and not using this method at all were 2,9 and 3,2 respectively which suggest that the ability of a deliberately modified BSC method as a tool of reaching corporate strategy can be actually worse than using other multicriteria management compensation methods.
 - (v) as for their ability to motivate their managers there was, based on their self-evaluation, no significant difference between companies using the BSC method and using other multiple criteria compensation systems

6 Conclusion

The survey confirmed (Lee et al., 2021) that the key issues of the BSC method include the choice of specific indicators of individual perspectives serving as a motivation tool. These indicators should correspond to the goals of individual perspectives, and thus the company as a whole, while the goals at lower levels of the organization should be set to support the goals of higher units (Soderberg et al., 2011). For example, fulfilling the criteria of the learning perspective and personal growth of employees should lead to the improvement of business processes, which should result in higher customer loyalty and, in turn, a higher return on invested capital (Quesado et al., 2022).

It also showed that the BSC method allows a reasonable level of flexibility provided its key rationale is adhered to. Especially, this means the chosen motivational indicators should be different for each organizational unit and at each management level, as it corresponds to the role and capabilities of their leaders. The interconnectedness of goals at higher and lower units does not mean that the same indicators should be used here: the use of the same motivational indicators (for example, profit indicators), albeit with different weights, at different levels of management, which can sometimes be encountered in practice, is a misunderstanding of the principles of the method. For example, if the goals at the top of the organization are expressed by profitability indicators, at a lower level of the company they may correspond to unit cost indicators, and to those at an even lower level, for example, requirements for better calibration of operational equipment, etc. The total number of motivational indicators should not be too large: two to four indicators related to each of the performance perspectives are optimal.

Also, the survey showed, that the successful use of the BSC method requires observing the perspectives from which the company's performance is evaluated. However, this does not mean that these perspectives cannot be slightly modified in a specific case in a way that corresponds to the nature of the company and its goals. An example mentioned above can be a financial institution that, when applying the BSC method, divided the evaluation perspectives into six groups. The perspectives were identified as financial, strategy implementation, customer, control, human resources and compliance. At the top of the organization, turnover, cost and profit margin indicators were assigned to the financial perspective, to the strategic number of customers in individual product segments, the number of new customers, the amount of managed assets per customer and revenue per customer by individual segment. The customer perspective was evaluated using market share, customer satisfaction with the company's services and service quality, and the control perspective based on the results of regular internal audits and checks on compliance with general legal and internal regulations.

Perspectives of human resources and compliance with standards were, in this particular example, evaluated based on qualitative (verbal) evaluations of superior managers. The indicators of the human resources perspective included, among other things, the level of teamwork, the results of training and development of employees and managers, and employee satisfaction. Adherence to standards included, for example, evaluation of managers' leadership skills, adherence to ethical principles and customer orientation, etc.

Connection and weighting of indicators

The survey emphasized that the motivational criteria used by the BSC method must be summarized in a certain way to determine the total remuneration of employees and converted into a bonus value. In some cases, it may be appropriate to weight individual indicators in a certain way. Summary or however, the weighting of the indicators should not violate the basic principle of the method, which is a balanced evaluation of the achieved performance. Here, too, one can encounter frequent problems in practice.

The meaning/prerequisite of the BSC method requires that managers or other employees receive a bonus only in a situation where they (at least partially) fulfil all of the motivational indicators, i.e., not only those whose fulfilment is easier in the given situation. Expressed in other words, good results in one of the evaluated perspectives (for example, customer satisfaction) should not be achieved at the expense of other important indicators, for example, profitability or indicators related to the assumptions of the successful development of the company in the future.

The easiest method to prevent an unbalanced assessment, the example of companies surveyed showed, is to exclude the possibility of compensation of one indicator by another. In practice, this means setting the minimum or maximum values of

certain indicators ("performance bars") that managers or units controlled by them must reach or not exceed. These "bars" can be, for example, slightly reduced target values of individual indicators. The payment of the bonus is conditional on the "bar" being reached in all cases.

An example can be the evaluation of the results of individual bank branches, in which the condition for bonus payment is the achievement of a certain level of customer satisfaction. This level can be set, for example, as 75 percent of the level achieved by the most successful branch. Similarly, the achievement of a certain rate of turnover growth or a certain result in the regular internal audit of branches can be used as "bars" to qualify for a bonus.

A balanced combination of motivational indicators can also rely on the evaluation of superiors. In this case, the resulting values of the indicators within the individual perspectives are divided into three groups corresponding to achieving, exceeding or not achieving the goals. These results are then summarized by superiors in the sense of whether the fulfilment of indicators in individual perspectives exceeds expectations, meets expectations or does not meet them. The results for the individual perspectives are then summarized again in an overall assessment falling into one of the three categories listed. The amount of the bonus is determined differently according to the category into which the summary assessment falls.

Even within this approach, it is possible to use "bar" methods. For example, a manager whose overall rating of the indicators falling under the financial or customer perspective is below expectations cannot receive an overall rating of "above expectations" corresponding to the highest bonus, regardless of the result of the evaluation of the other perspectives.

The weights of individual motivational criteria used in determining the bonus should correspond to the importance of individual indicators for achieving the goals of individual perspectives, or goals of the firm as a whole, and should remain relatively constant. Although financial performance criteria usually receive the highest weight, their relative importance should not be so high that it overshadows other indicators.

The most frequently used method of weighing individual motivational criteria is based on the fact that performance criteria are assigned percentage weights, the sum of which is equal to one hundred. A variant of the mentioned procedure is to weigh the individual motivational criteria by assigning them percentages corresponding to the share of the basic salary, which the employee receives as a bonus for meeting the given criteria. In this case, the bonus corresponding to the fulfilment of all motivational criteria is given as a percentage of the basic (annual) salary corresponding to the sum of the partial percentages obtained for individual indicators.

In this case, the weights of the individual criteria are determined indirectly – the amount of the percentage of the basic salary that can be obtained as a bonus for meeting the individual criteria. The advantage of this procedure is the easier possibility to reward managers even for achieving better than planned results. In this case, the manager receives an additional bonus for exceeding the performance targets determined again as a percentage of the base salary. This procedure is usually more suitable especially for business managers, for whom it is not desirable to create a "ceiling" for their performance rewards.

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THE NEW STUDY PROGRAM COUNSELING AS A RESPONSE TO THE NEEDS OF THE TIMES

^aMÁRIA ŠMIDOVÁ, ^bKATARÍNA SLEZÁKOVÁ

^{a,b} *Trnava University in Trnava, Faculty of Theology, Kostolná 1, P.O. BOX 173, 814 99 Bratislava, Slovakia*
 email: ^amaria.smidova@truni.sk ^bkatarina.slezakova@truni.sk

Abstract: In the article, we aim to present the process of forming a new study program and subsequently, the process of establishing a new profession in Slovakia. We are talking about a new profession of Counseling, which currently has an important place in supporting people in various stressful situations. Thanks to foreign partners, the Faculty of Theology of the University of Trnava works intensively on rapid growth of the credibility of counseling as a profession. Efficiency of the counseling as a profession has been proved by recent multifactorial empirical research. Result of this research, as well as other sub-researches, was approval of a new professional oriented study program with focus on counseling establishing in Slovak environment.

Keywords: counseling, study program, counseling establishing

1 Introduction to the issues of counseling

1.1 Definition of counseling

Counseling, also called professional mentoring in Slovakia, is one of the methods of social work that presents a help for clients coping with difficult life situations. This is a form of a client support in which a mentor guides a client to activate his/her own inner resources, necessary to solve the problem. Let us call it a help to self-help. The priority of the mentoring process is building such a professional helping relationship that is non-directive and based on trust, esteem and respect. It is built by using acceptance, empathy, congruence and effective communication. So it is about making a conversation in which the guided person is able to listen carefully. The conversation should have a support character, aimed at a searching and opening possibilities that the person had not identified or used until then. So the goal is not to advise, but to discover and strengthen. It is important to lead a guided person to searching for inner strength in oneself, to the ability to discover a possibility for solving the given problem and motivations for its implementation. The concept of counseling is based on relationship equality between social worker and client, accompanying and accompanied.

Another pillar is the acceptance of the accompanied client, who with a help of the mentoring person accepts responsibility for his/her actions and personal development so that he/she knows how to make responsible decisions and live an independent life. The term of counseling appeared in the literature as a description of activities aimed at social or psychological problems in 1909 used by Frank Parsons. Its development significantly more appeared in the United States of America at the end of the 40's, while its development was primarily accelerated by two factors: the need to form a strategic and effective help for soldiers returning from war and the birth of humanistic psychology, which presents a new vision of man in which the quality of relationships, free choice, creative and planning stimulus of the individual gain importance. These factors gave rise to the creation of a new profession of counsellor, which expanded from the beginning of 50's, especially in Anglo-Saxon countries. Helping relationship or "counseling" responds to the needs of a social character such as existential questions, loss of supporting points, the constant changes of society and the inevitable requirement of sufficiently suitable and adaptive manners (Meier, T.S. - Davis, R.S, 1996).

1.2 History and establishment of counseling abroad

Counseling as a specialized professional activity began to develop dominantly in the sphere of professional orientation. In this period, qualitative growth is conditional by creating an organized form of assistance. This help is not only aimed at youth and parents, but also in the field of economics or education (e.g. when choosing a profession, the study, schools). The onset of counseling was accompanied by the establishment

of counseling centers and counseling centers institutions focused on various types of specialized consulting and counseling services. In 1937, at Duke University in the USA, the first course of "pair counseling" took place and in 1943 the first counseling manual for social workers was published. The theoretical foundations for this form of intervention were created by Carl Ransom Rogers, an American psychologist and founder of the so-called non-directive psychotherapy, who in 1951 in the work "On client-oriented therapy" developed a new approach to counseling and therapy. The non-directive client-centered psychotherapy suggests an approach that "focuses on the person". He emphasized that individuals have, within themselves, a source of self understanding and self-directed behavior.

By the term "counseling" Rogers understood a relationship in which the client is assisted in his/her own difficulties without being denied the possibility of free choice and own responsibility. The central hypothesis of such an approach was based on a huge source self-understanding and basic attitudes of the individual. Another factor that influenced the development of counseling can be identified in the field of prevention from a model focused on the disease to a model centered on the health of the individual in which the concept of prevention took a key role.

During the 70's, counseling began to deal with adolescents and their families and consequently, an increasingly urgent need to intervene in school and social environment. The traditional socially branched network of multigenerational families was gradually reduced so that it created a space for a type of family that no longer created so many social relationships and often relied on social services in case of need for external help (Ivey E. A, 2015).

In Europe, counseling began to be used in the 70's in Great Britain as a service with a pedagogical focus and as a tool for supporting social services and volunteering. Subsequently, two important related associations were established: the British Association for Counseling (BAC) in 1977 (since 2000 known as the British Association for Counseling and Psychotherapy – BACP), and the European Association for Counseling (European Association for Counseling – EAC) in 1991. The European Counseling Association later defined educational standards and established criteria for the necessary range of education hours, education methods as well as the standards of ethical behavior of counselors. The European Escort Association published the following definition in 1995:

"Counselling is an interactive relationship that serves for solving clients' problems. These issues can be social, cultural or emotional and a counselor will approach to them holistically. The client can be a person or a family group or even an institution. The general goal of counseling is to help clients recognize opportunities for living more satisfied and valuable lives as individuals and as members of society." (*Definition of Counselling, 2016*) In the Eastern Europe countries, counseling is still less known and little used, thus leaving more space for other forms of help - psychological, psychiatric, social etc.

2 Preparation for the establishment of counseling in Slovakia

The process of preparation and establishment of the new Counseling profession in Slovakia can be presented as a process of finding answers in the four basic perspectives which are acceptance of culture, methodological starting points, needs and conditions.

We present our run which represents a ten-year period of research, study, practical verification, preparation of the new study program until its opening in the academic year 2022/2023.

2.1 Results of research aimed at establishing counseling in selected helping professions

At the beginning of the creation of the new program, it was necessary to build a scientific and professional basis in Slovak environment that consisted of extensive research that became the basis for creating conditions for the promotion of Counseling as an official profession in the country. This research was carried out in the professional and erudite background of already existing scientific and professional areas, namely social work and pastoral theology.

The first perspective is the answer to the question: To whom?

We focused on the needs of the people living in our country and on what our people and our culture consider as important. It was necessary to respond to important cultural aspects and needs, resulting from the characteristics of people living in Slovakia. As important, in the field of culture, showed the three-year project "Effective Practice", which consisted of several meetings for which three groups of people were invited: teachers, students and specific groups of possible clients to counselling. In a safe environment, they talked, saw and got to know their situations, problems, ways of communication, thinking and decision making. In the conclusions of these meetings, there was carried out a qualitative research in the form of the "focus group", the results of which showed three basic cultural aspects, namely spirituality, identity and self-confidence (Šmidová et al., 2021).

The second perspective is the answer to the question Where?

It was about finding out what the social and personnel situation is like in Slovakia. When examining of these perspectives, the results of sociological research for the other period were taken into account for they realistically represented the social situation in Slovakia and indicated the areas that require a care (Šmidová et al., 2019). Also, personnel options to provide such assistance, were taken into account. At the conclusion of this research, four basic areas were identified: *family, palliative care, young people, spiritual area*. As personally closest showed the so far developed profession of a social worker with a specific orientation to professional accompaniment. Professional training of teachers for this type of the program was carried out continuously in cooperating institutions, namely Central Florida University (US), Maryland University (US), Università Lateranense, Istituto Camilianum (Italy) and ASPIC (Italy).

The third perspective is the answer to the question How?

We took a closer look on the steps that need to be taken when implementing counseling to the Slovak social system. This area of research was related to the consideration of social state policy, its priorities and needs, which are defined in various documents. One among them was the National Strategic Framework for Family Support and Demographic Development by the year 2030, which was developed in accordance with the principles of creating public strategies in a participatory manner with the involvement of relevant actors. For the purposes of initial expertise and processing of the initial analysis of priority areas, Family and Demographic Development department members of the government of the Slovak Republic (National Strategic framework for supporting the family and demographic development until 2030) also participated. In the field of implementation counseling in the social system, the Faculty of Theology of the University of Trnava has implemented several scientific projects. Among the most significant was the project APVV 15-0189 - Selected factors of pro-family strategy and the support of a stable family in a multicultural environment, which was granted by Ministry of Education of the SR. It was a long-term research on a pro-family national strategy. Its results were presented and it was accepted by the authorities of our social system. Another similar project is KEGA 006TTU-4/2021 - Creation of a module of distance education of pastoral counseling for selected helping professions – social work and pastoral theology.

The fourth perspective is the answer to the question Who?

In this area, it was necessary to choose a suitable methodology and a professional approach, to find suitable partners as professional guarantors and source of know-how. This perspective was clearly defined from the beginning of the process, resulting from long-term cooperation with foreign partners in the US, namely Scranton University in Scranton and Central Florida University in Orlando (Florida); in Italy collaboration with Università Lateranense in Rome and ASPIC in Verona.

Faculty of Theology of Trnava University in Trnava organized several international conferences and seminars with significant foreign participation in order to support the establishment of an official counseling profession in Slovakia. University of Scranton (USA) in 2014, international conference in cooperation with the Institute of Mental Health (Hungary) in 2016 and international conference in cooperation with the University of Central Florida (USA) in 2017 and 2021.

The chosen strategy is interesting from a global point of view because it covers the key perspectives for the formation of a new professions: culture, social situation, methodology and implementation of counseling in the social system. The result of the mentioned activities was the awarding of the Faculty of Theology of the University of Trnava in Trnava by the Slovak Accreditation Agency for Higher Education of the Slovak Republic and subsequently granting of accreditation of a bachelor's professionally oriented Counseling study program in the department of social work. The study program opened from the academic year 2022/2023. The Slovak Accreditation Agency in its general summary report on study programs in Slovakia evaluated this study program positively. In Its opinion stated: one of the examples of interesting study programs is the study program counseling of the University of Trnava aimed at caring for and accompanying people in need, difficult disabled or disadvantaged and vulnerable population groups such as seniors or children. This offer includes a deep social dimension. Graduates will have a real opportunity to find employment in the field of social care and in the department of health and social services.

3 Opening of the department of counseling as a response to challenges of Pope Francis

3.1 Analysis of selected apostolic exhortations and encyclicals of Pope Francis

Counseling as an approach was chosen at the Faculty of Theology also because of the current challenge of Pope Francis. In his apostolic exhortations and encyclicals he implicitly and explicitly names counseling as "accompanying", while recommending it for application in the missionary and pastoral activities of the Church. By analyzing selected texts from the Pope Francis's documents, it is clear that he has known and clearly, since the beginning of his pontificate, identifies the counseling method. He calls for the implementation of accompanying several target groups - of families, engaged and newlyweds, divorcing and divorced spouses (Amoris Laetitia, Art. 30), the poor, the sick, women in difficult situations (Evangelii Gaudium, art. 214), victims of sexual abuse in the Church (Vos estis lux mundi, art.9), young people (Christus vivit", art. 30), seniors (Fratelli tutti, art. 20), health disabled persons or migrants (Amoris laetitia, Art. 30). He also recommends the establishment of "listening centers" - centers where people in various stress situations would find a complex of services including counseling services. The establishment of a similar type of center is also the goal of Trnava University in Trnava - Faculty of Theology.

Pope Francis perceives closeness, care, acceptance as the main elements of accompaniment and relationship. He also considers active listening of the accompanied to be very important. When describing the use and the realization of the processes of this approach thus approaches the scientific understanding of the

definition of counseling, with regard to the application of accompaniment to specific missions of the Church. He recommends to use it either in traditional catholic or secularized countries.

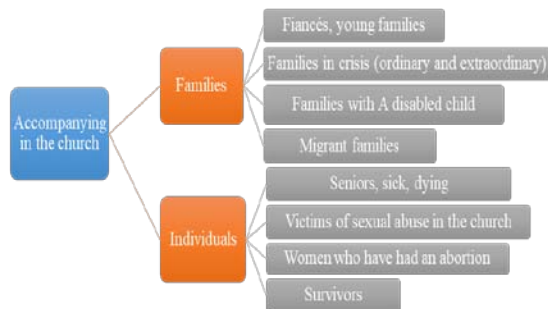


Fig. 1: Pope Francis' call to accompany specific target groups (Source: custom processing)

Evangelii Gaudium

Right at the beginning of his pontificate (2013), Pope Francis defines in the apostolic exhortation *Evangelii gaudium* accompaniment as one of the five basic attributes of the Church, which not only takes the initiative, gets involved, bears fruit, celebrates, but also "accompanies humanity to all of its journeys, no matter how difficult or long they may be." At the same time, he reminds that accompaniment should be connected with a clear goal, which is the ideal of the gospel, but it is important to patiently and authentically take into account the various stages of growth of accompanied persons (*Evangelii Gaudium*, Art. 45). Through accompaniment, it is possible to express care and strengthen the richness that already exists in Christendom. At the same time, it can be used to support new processes of evangelization in deeply secularized countries (*Evangelii Gaudium*, Art. 69).

In today's society wounded by anonymity and at the same time a huge desire for information about others, the Church needs a sense of closeness in order to contemplate, to feel emotion and stopping by the close person whenever necessary. In this way, priests as well as erudite pastoral workers, should educate in the field of "the art of accompanying", and thus to know how to feel the value of every human being who is accompanied by them. At the same time, the Pope Francis reminds that it is important to give progress a healthy rhythm of closeness with a view full of respect and compassion which, at the same time, heals, liberates and encourages maturing in the Christian life (*Evangelii Gaudium*, art. 169). At this point, we would like to note that pope Francis by the term "healthy rhythm of closeness" means the professional relationship and professional boundaries, which are required mainly from the erudite accompanying person (counselor) during the accompanying.

The basic technique of counseling as a method used in several spheres of activity is active listening. The importance of this technique is also noted by the Pope Francis when he says that everyone needs to practice the art of listening, which involves more than just the ability to hear. "The first thing in communication is the ability of the heart to allow closeness, without which there is no real spiritual encounter. Listening helps us find the appropriate gesture and word which forces us to leave the peaceful position of viewers. Based on this respectful listening itself, which is capable of compassion, it is possible to discover paths of authentic growth, to renew the desire for the Christian ideal and the effort to fully respond to God's love as well as the eagerness to develop it - the best that God has sown in a person's life." (*Evangelii Gaudium*, art. 171)

Amoris Laetitia

The post-synodal apostolic exhortation *Amoris Laetitia* (on love in the family) is another document of pope Francis, in which he

recommends implementing accompaniment in the Church, this time targeting engaged couples, young families and families in crisis. He used the term "accompanying" more than 40 times in this document, thus explicitly referring to its significance and usability in pastoral care. The Church should be a place with possibility to accompany and help in matters related to the growth of love, overcoming conflicts or raising children. Very specific are families with disabled children, or families of migrants, where he emphasizes the importance of integrating vulnerable persons and the importance of compassionate acceptance (*Amoris Laetitia*, Art. 47). Acceptance (of an accompanied person) is one of the main attributes of the definition of counseling, as already defined in the introduction of the article. In the exhortation, he devotes a lot of attention to accompanying betrothed and newlyweds. The preparation for marriage should emphasize that the engaged couple do not see the wedding as an end of journey, but to accept marriage as a vocation that moves them forward. Young couples need to be accompanied in such a way as to deepen and enrich their conscious and free decision to enter into marriage.

The Pope Francis clearly defines the spectrum of crises that every family goes through. It lists the common ones from separation from parents, birth of a child, problems of education to the "empty nest" crisis. However, personal crises are also added to these, connected with economic, work, emotional or spiritual problems that can change family life. Here, it is not a mistake to seek external - professional help (*Amoris Laetitia*, Art. 236). However, Pope Francis goes further, according to him, accompaniment has its place even after separations or divorces. Again, it recalls the acceptance of all persons who are going through separation, abandonment and loneliness. With the help of specialized counseling centers that he calls for establishing in each diocese, these persons should be accompanied with all care. It should not be forgotten about solving the economic aspect of family breakdown and eliminating trauma committed against children. Further, the Pope presents accompanying someone after death of spouses, while it is important that the escort knows the peculiarities of each stage of mourning and helped the mourning through this stressful period of life with his/her presence (*Amoris Laetitia*, art. 253).

Christus Vivit

Post-synodal apostolic exhortation of pope Francis called *Christus Vivit* is dedicated to young people and to all God's people. In it, Francis defines how to communicate with young people in today's world, who should be their example and how important it is to support their growth by accompanying them. Specific feature of today's youth is social involvement, while young people are not bypassed even volunteering, active citizenship and social solidarity. Here is the place for adults to accompany young people and encourage them in discovering their talents and abilities and creativity, which they will know how to use those in social engagement (*Christus Vivit*, art. 170). The Pope Francis also reminds that the Church should make the necessary efforts to accompany young people due to "cultural colonization" through which young people lose their most valuable features of individuality and identity. However, he adds, young people are also free human beings who, thanks to the accompaniment, can boldly and creatively find new ways to shepherd themselves. It would be useless to present them pastoral manuals rather than they should be offered to use their talent, skills and wit so they grow into mature Christians (*Christus Vivit*, no. 203). At this point, one cannot overlook that Pope Francis speaks of "help to self-help", which is a simple definition of counseling from a wider perspective.

The Pope Francis also adds, at the end of the exhortation, that the role of accompanying of young people has his/her family as a primary task, later community, which has a big value in the eyes of young people. At this point, Pope Francis also acknowledges that there is a lack of accompanying persons in parishes and therefore it is necessary to educate not only priests, but also active lay people who would be qualified for that kind of work. He appeals to religious and seminarians to be more capable to

accompany, as they take a responsible place in the life and guidance of young people (Christus Vivit, 245).

Very important part of the exhortation is paragraph 246, when Pope Francis states the expectations of young people due to the personality of the accompanying person. They have a clear idea of what he/she is like: a faithful christian, constantly striving for holiness, full of trust, non-judgmental, actively listening to needs of the young, he recognizes his limits, he/she knows how to recognize his humanity and therefore understands mistakes, he/she does not lead the young to a passive following, but walks alongside with them being active participants on the road. The guide should respect the freedom of young people and realistically see the possibilities that exist within the young to be able to use. All accompanying should receive solid basic training and strive for permanent formation (Christus Vivit 246). It is clearly very important for the guide in order to be able to guide, he/she himself/herself must undergo the path of growth by being guided and so not to impose his/her own plans about another's way of life.

3.2 Summary

In offered official documents of Pope Francis, we focused on his appeal to the use of guidance (counseling) in pastoral care. It is important to mention that across by most of his documents, the recommendation to accompany different groups in the Church and society occurs very often, while the Pope Francis clearly defines the methods of its application, the correct selection of tools and its appropriate location of use. It also expresses the need for formation of lay workers in family pastoral care with the help of psychologists, educators, social assistants and other experts, especially those with experience in accompanying. They have it a real tendency to embody pastoral proposals in the specific family worries. (*Amoris Laetitia*, Art. 204). If his message regarding accompaniment in the Church could be expressed by using specific elements in pastoral activity, from the point of view of Christianity, these could be acceptance by the accompanying person, active listening, expression of respect, empathy and acceptance of the accompanied person, married couple or family.

The opening of the new Counseling study program and the process of its following establishment in Slovakia is understood, by the Faculty of Theology, as a response not only to the appeals of Pope Francis, but also as a response to the actual situation in Slovak society.

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Primary Paper Section: A

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NEXUS AMONG UNEMPLOYMENT, POVERTY AND CRIME IN SLOVAKIA

^aEMÍLIA DUĽOVÁ SPIŠÁKOVÁ, ^bBARBORA GONTKOVIČOVÁ

Faculty of Business Economy with seat in Košice, University of Economics in Bratislava, Tajovského 13, 041 30, Košice, Slovakia

email: ^aemilia.dulova.spisakova@euba.sk,

^bbarbora.gontkovicova@euba.sk

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Abstract: The deepening of social differences can be an incentive for wide-spectrum crime. First the pandemic, then the war conflict in Ukraine and the energy crisis with effects on inflation rate resulted in many residents facing existential problems that change their behavior. These, in the worst case, can result in the commission of crime. Therefore the main aim of the article will be to evaluate the relation between crime, unemployment and poverty in conditions of Slovak republic. A partial aim will be to find out whether long-term unemployed people contribute more to the commission of crime, and whether the level of education achieved by the unemployed has an impact on the commission of individual types of criminal acts.

Keywords: unemployment, poverty, crime, education.

Introduction

Dynamic social development, the transformation of the economy and property relations were reflected in the long-term social differentiation of society, the increase in unemployment and the loss of social security for a significant group of the population. The deepening of social differences can be an incentive for wide-spectrum crime. The current situation was exacerbated by the consequences of the COVID-19 pandemic and the war conflict in Ukraine. Business closures, production restrictions and suspensions, the paralysis of the service sector during the corona crisis and high inflation as a result of the war conflict have brought many households closer to the poverty line. Several residents face even existential problems that change their behavior, which in the worst case can result in committing criminal activity. Therefore, the article will focus on the issue of relation between crime, unemployment and poverty. The topicality of the issue is underlined by the fact that all three monitored areas represent partial goals of Agenda 2030. In defined lines, they develop the state achieved in the EU member states based on the fulfillment of the targets of the Strategy Europe 2020, while reflecting on the need to incorporate the principle of sustainability in the monitored areas.

1 Theoretical framework

Unemployment, poverty and crime represent a societal problem that must be solved. Loss of job and inability to find a suitable job, or unwillingness to work in general or because of low pay, lowers the living standard of residents in some regions. Due to no or very low income in the form of various benefits received from the state, these people are a risk group that could represent potential perpetrators of crimes.

The criminal phenomenon is influenced by economic and sociocultural factors, such as population density, unemployment, income, poverty and education (Mokline, 2018) and a number of negative effects generated by the contradiction of these relationships (Larii, David, 2019). Crime is one of the big problems facing various countries, whether developed or developing, and it is difficult to avoid (Armin, 2020). This term refers to any violation of the law that may result in legal action.

Several studies have proven that unemployment and poverty have a positive and significant impact on crime (Abdila et al., 2022; Badzaghua, Gondauri, 2021; Imran, 2018; Mirjat et al., 2017; Buonanno et al., 2015). Unemployment causes crime in society (Fadaei-Tehrani, Green, 2002) and a decrease in unemployment leads to a decrease in the crime rate (Shah,

Soomro, Mirjat, 2019). According to Jawadi et al. (2021), the maintenance of stable economic activity is crucial for stabilizing the incidence of non-violent crime. This is related to the fact that economic depression causes increased crime, while economic prosperity reduces criminal activity (Armin, 2020).

There are many factors that influence unemployment, poverty and crime, some of which are common. Even education itself offers us multiple perspectives on their mutual connection and casualness (Huang, Maassen van den Brink, Groot 2009). Low education makes it difficult for low-income people to meet their needs. In the midst of globalization, which is marked by a materialistic lifestyle, it is not out of the question that someone will commit an illegal or unnatural act to get money. General expectations in the given area relate primarily to the relationship between long-term unemployment, poverty and crime. On the other hand, it is necessary to point out the fact that education does not guarantee a person's non-criminal behavior. Here the question arises of the relationship between the level of education of unemployed persons and economic crime, which can be claimed as a more sophisticated form (Polák, 2020). According to Kuchta et al (2005), economic crime consists of crimes committed during the business of economic entities, especially by persons operating inside these entities, damaging or threatening individual or collective rights in the economic sphere, abusing the weaknesses of the economic system or its institutions, causing a weakening of trust in the economic and social system, motivated by profit or desire for power, latent in nature and in its mass form threatening the functioning of the rule of law.

Unemployment causes a low level of income. Subsequently, low income leads to poverty. Poverty, as a social problem of society at the local and global level, represents living conditions in which individuals do not reach a minimum standard of living (Shah, Soomro, Mirjat, 2019). The threat of an increase in the poverty rate caused by many unemployed can appear at any time and can result from dissatisfaction with government policies (Abdila et al., 2022). Therefore, the state has the power in its hands to adopt the necessary legislation that would actively influence employment, thus preventing poverty and contributing to the reduction of crime. According to Imran (2018), it can be concluded that poverty ultimately leads to property crime. Also important is the subjective view of poverty, which may reflect changes in societies that are not captured by official indicators of poverty (Želinský, 2022).

Long-term unemployment is also a problem, which, according to a study by Nordin and Almen (2017), shows a strong association with violent crime, even greater than the effect of overall unemployment on property crime. The duration of unemployment probably increases the tension that promotes violent behavior (Lalotiot, 2016).

Covid-19 caused that less educated, long-term unemployed and unskilled people to be left behind during the pandemic. If we look at the breadth of social policies and aid programs, we see that they basically covered the economically active population and ignored those who needed it most. This highlight their social isolation and the consequences of the crisis contributed more than ever to their poverty (Kooli, 2022).

The topicality of the investigated issue is also enhanced by the fact that the financial situation of many people has significantly worsened in the form of a cost-of-living crisis, which is driven by high-energy prices, the war in Ukraine and uncontrollable inflation. It was inflation last year that contributed to a significant increase in household living costs, but also to an increase in the input costs of companies (as employers). Lower disposable income, or job loss significantly affects the unemployment rate, exposes the population to the risk of poverty with possible consequences for their behavior that leads to criminal activity.

2 Data and methodology

The last available data from the databases, namely Statistical Office of the Slovak Republic, Eurostat and Ministry of Interior of the SR is used to process the article. All results of the analysis in the form of graphs and tables are processed in Microsoft Office Excel. Mathematical and statistical methods (correlation, regression) were used in addition to standard logic methods intended for processing data (acquisition and data collection, analysis) and making inferences (summarization of results, synthesis).

Correlation analysis determine the degree of association (common variability) of two dependent or functionally undifferentiated variables. A graphical expression of dependence is a correlation graph, where the values of the independent variable are plotted on the x-axis (in our case crime) and the values of the dependent variable on the y-axis (unemployment, long unemployment, and poverty). According to the nature of the distribution of points in the graph, we can estimate how strong the dependence between quantities exists, or there is no dependency. A correlation coefficient is used to express the tightness of the correlation. In the case of a relatively small sample of data and the violation of the normality assumption for some variables, it is appropriate to analyze the files by simple rank correlations using Spearman's rank correlation coefficient matrices. The range of the correlation coefficient determines the strength of the correlation, which can be interpreted as follows: 0.00-0.19 "very weak"; 0.20-0.39 "weak"; 0.40-0.59 "moderate" (*); 0.60-0.79 "strong" (**); 0.80-1.00 "very strong" correlation (***) (Evans, 1996).

It is a non-parametric method describing monotonic dependence, not only linear, but generally increasing or decreasing. A non-parametric characteristic of the dependence of random variables X, Y is the Spearman rank correlation coefficient given by the relation:

$$r_s = 1 - (6\sum d_i^2 / n(n^2 - 1)) \quad (1)$$

where r_s is the coefficient and n is the number of points in the data set. For each point (x_i, y_i) , the square of the difference in the ranks of the two coordinates is represented by d_i^2 and the sum of each of these squares is represented by the expression $\sum d_i^2$.

We verify the statistical significance of the relationship between level of education of unemployed and general and economic crime through regression analysis. It was preceded by tests of normality (Shapiro-Wilk test), autocorrelation (Durbin-Watson test) and heteroskedasticity test (Breusch-Pagan test).

The dependent variable is the crime indicator (Y - total, general and economic), and the independent variables are the indicators of education (X).

$$Y_{it} = \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + U_{it} \quad (2)$$

The coefficient of determination (R-square), F test, and the p-value were used for assessing the suitability of the trend function. R-square is the proportion of the variance in the dependent variable that is predictable from the independent variable(s) and measures the strength of the relationship between the model and the dependent variable on a convenient 0–100% scale. The statistical significance of individual regression coefficients is assessed by p-value. The overall F-test determines whether this relationship is statistically significant.

3 Development trends of unemployment, poverty and crime in Slovakia

In order to fulfill the main aim of the article, we first monitored the development of individual indicators. Based on the latest available data from Eurostat, in 2022 the unemployment rate in Slovakia was at the level of the EU average (6.1 %). Slovakia was followed by southern countries (Cyprus, Greece, Italy, Croatia and Spain), the northern countries of the EU (Sweden,

Finland, Latvia) and also France. The country achieves a worse position in the indicator of long-term unemployment. In 2022, of the total workforce in the country, 4.1 % are unemployed for more than 12 months. Only Italy, Spain and Greece are behind Slovakia.

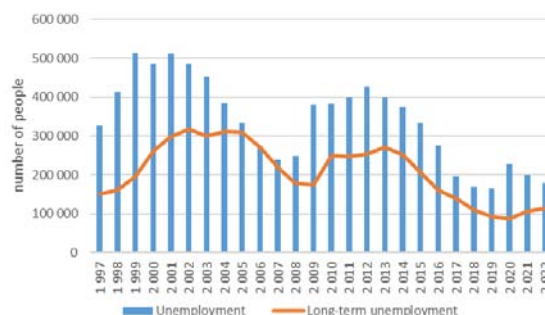


Figure 1. Development of unemployment and long-term unemployment in Slovakia during the period 1997-2022; source: Own processing according to the data from Statistical Office of the Slovak Republic, 2023

Figure 1 shows the development of the total number of unemployed and long-term unemployed persons in Slovakia. Based on the data, it can be concluded that in the long term, the number of unemployed as well as the long-term unemployed is decreasing. More than half a million inhabitants were unemployed in 1999, while the highest number of long-term unemployed was in 2002 (317 000 persons) and they represented up to 65 % of the total unemployment. The pandemic caused by the disease COVID-19 contributed to the year-on-year increase in the number of unemployed by almost 62 000 people (the period of 2019 and 2020), but this was reflected in long-term unemployment until a year later. In 2022, the number of long-term unemployed persons was 26 000 higher than in 2020.

The second evaluated indicator is poverty from the point of view of the development of the total number of persons living below the poverty line and also the development of the poverty rate. Due to the unavailability of data, a shorter time period was monitored.

Compared to the EU member states, Slovakia ranks seventh place in the ranking together with Poland in the poverty rate. The lowest poverty rate (10.2 %) was recorded in 2022 in the Czechia. It was followed by Hungary, Slovenia, Denmark, Finland and Belgium. Conversely, poverty rates of more than 22% were recorded in Latvia, Estonia and Bulgaria (World Population Review, 2023).

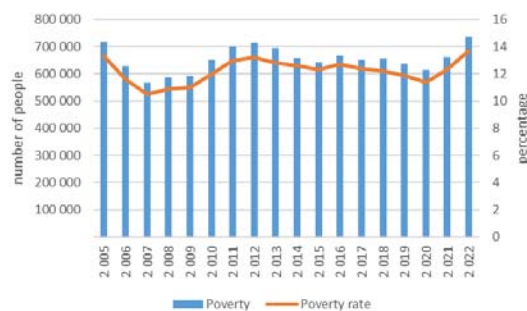


Figure 2. Development of poverty and poverty rate in Slovakia during the period 2005-2022; source: Own processing according to the data from Statistical Office of the Slovak Republic, 2023

If we look at the longer-term development of the indicator in Slovakia (Figure 2), we see that in 2022 the country showed the highest number of people living below the poverty line (735,725 people), which represented 13.7% of the population. On the other hand, the least population at risk of poverty was in 2007, when Slovakia achieved the highest economic growth

among EU member countries and was considered the economic tiger of Europe.

The last indicator entering the subsequent correlational and causal analysis is the crime indicator. The safest country in the EU, in which the fewest crimes are committed, is Slovenia (22.28 crimes), followed by Estonia and Croatia. Slovakia is in 11th place in this ranking with 30.37 crimes per 100 000 inhabitants.

Of the EU member states, France is the country with the highest crime rate, with 52 crimes per 100 000 inhabitants. It is followed by Sweden with 48 crimes, Greece and Ireland with almost 46 crimes per 100 000 inhabitants.

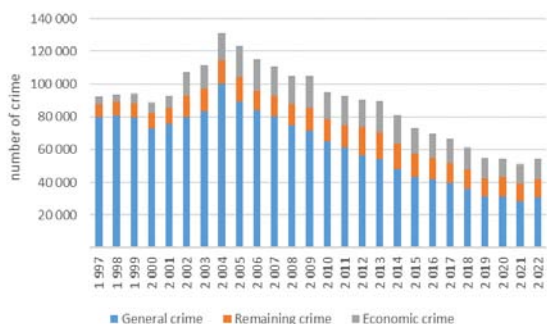


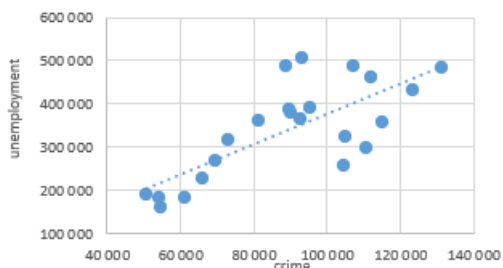
Figure 3. Development of crime in Slovakia during the period 1997-2022; source: Own processing according to the data from Ministry of Interior of the Slovak Republic, 2023

Looking at the long-term development of crime in Slovakia (Figure 3), it is possible to note a downward trend in this area since 2004. In that year, 131 244 crimes were committed in the country. Other years marked by the pandemic did not cause an increase in crime. The change occurred only in 2022, when the number of committed crimes reached the level of 2018 and 2019, which may be the result of too high inflation leading to a decrease in the real income of the population.

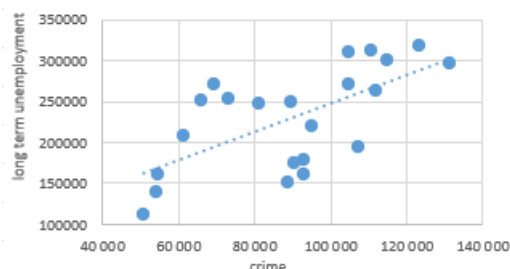
It is necessary to state that during the observed period there was a change in the structure of committed crimes. While in 2004, general crime accounted for 76.5 %, economic crime 12.5 % and remaining crime 11 %, by 2022 the importance of economic and remaining crime increased (more than 20 % share of total crime in both cases).

3.1 Impact unemployment and poverty on crime

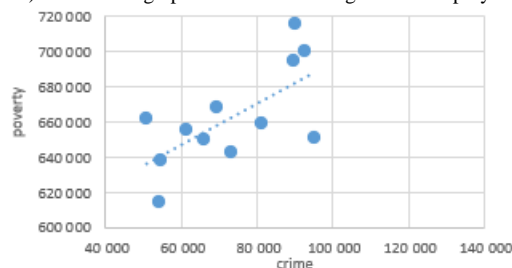
The purpose of a correlation graph is to provide a general illustration of the relationship between the two variables. Two variables have a positive association when above-average values of one tend to accompany above-average values of the other, and when below-average values also tend to occur together. This applies to all three graphs analyzed (Figure 4).



a) Correlation graph for crime and unemployment



b) Correlation graph for crime and long term unemployment



c) Correlation graph for crime and poverty

Figure 4 Correlation graphs

A positive correlation means that with an increase of unemployment and long term unemployment rate, dependent variable - crime increase (Figure a and b). It is the same with the relationship between crime and poverty, although the graph suggests that the intensity of the relationship is lower in this case (Figure 4c).

Table 1 Correlation matrix 1

	TCR	UNE	LUNE	POV
TCR	1			
UNE	0.9263***	1		
LUNE	0.9594***	0.9609***	1	
POV	0.6713**	0.6583**	0.6762**	1

* TCR (total crime); UNE (unemployment); LUNE (long term unemployment); POV (poverty)

While correlation graph display the strength, direction, and form of the relationship between two quantitative variables, by calculating the correlation coefficients, it is possible to quantify the strength of the links between the observed variables (Table 1). Very strong correlation was recorded in case of the relation between total crime and unemployment and also between total crime and long term unemployment.

3.2 Impact of education level of unemployed on crime

As part of our article, we also deal with the issue of the education of the unemployed as a risk factor for committing crime. The correlation analysis confirmed the general assumptions in the researched area. In the case of general criminality (Table 2), the relationship with the number of unemployed with no education or primary education and also with lower secondary education shows a high degree of correlation.

Table 2 Correlation matrix 2

	GCR	NEPE	LSE	CSE	HE
GCR	1				
NEPE	0.9335***	1			
LSE	0.8000***	0.8636***	1		
CSE	0.6366**	0.7185**	0.9566***	1	
HE	-0.5908*	-0.5695*	-0.3169	-0.0783	1

* GCR (general crime); NEPE (no education, primary education); LSE (lower secondary education); CSE (complete secondary education); HE (higher education)

The regression was used for verification of the statistical significance of the relationship between unemployed level of education and general and consequently, economic crime.

Equation for the general crime regression model:

$$GCR = 0.612404348NEPE + 0.342128067LSE - 0.45360398CSE + 0.082981241HE + 18.27921062$$

The F-test is used to check the appropriateness of the multiple regression analysis. Its P-value is $6.64E-08 < 0.05$, so multiple regression analysis is appropriate. The adjusted R Square is 0.862696, which means that 86.27% of the variation in the dependent variable is affected by the independent variables. From the given data, the greatest influence (ceteris paribus) on crime has no education, primary education factor, with a regression coefficient value of 0.612 (Table 3).

Table 3 Estimated parameters for regression model 1

R Square	0.888849					
Adjusted R Square	0.862696					
Standard Error	7.934817					
Observations	22					
F test	6.64E-08					
	<i>coeff</i>	<i>std err</i>	<i>t stat</i>	<i>p-value</i>	<i>lower</i>	<i>upper</i>
<i>Intercept</i>	18.279	14.633	1.249	0.229	-12.594	49.153
<i>NEPE</i>	0.612	0.212	2.882	0.010	0.164	1.061
<i>LSE</i>	0.342	0.250	1.366	0.190	-0.1863	0.871
<i>CSE</i>	-0.454	0.336	-1.3481	0.195	-1.164	0.256
<i>HE</i>	0.083	0.356	0.233	0.819	-0.669	0.835

The relationship between unemployed with no education of primary education and general criminality proved to be statistically significant.

In addition, we were also interested in the relationship between economic crime and the level of education of the unemployed. Based on the correlation analysis (Table 4), we observe only a weak correlation between economic crime and the unemployed with higher education. For other levels of education, the correlation coefficient is even lower.

Table 4 Correlation matrix 3

	<i>ECR</i>	<i>NEPE</i>	<i>LSE</i>	<i>CSE</i>	<i>HE</i>
<i>ECR</i>	1				
<i>NEPE</i>	0.1025	1			
<i>LSE</i>	-0.0370	0.8636***	1		
<i>CSE</i>	-0.0553	0.7185***	0.9566***	1	
<i>HE</i>	0.2371	-0.5695*	-0.3169	-0.0783	1

* *ECR* (economic crime); *NEPE* (no education, primary education); *LSE* (lower secondary education); *CSE* (complete secondary education); *HE* (higher education)

However, the regression model also confirms the existence of a relationship between the crime indicator and the unemployed with higher education.

Equation for the economic crime regression model:

$$ECR = 0.153465 NEPE + 0.047634 LSE - 0.14886 CSE + 0.385893HE + 5.02192$$

Table 5 Estimated parameters for regression model 2

R Square	0.38081					
Adjusted R Square	0.235118					
Standard Error	3.137322					
Observations	22					
F test	0.072036					
	<i>coeff</i>	<i>std err</i>	<i>t stat</i>	<i>p-value</i>	<i>lower</i>	<i>upper</i>
<i>Intercept</i>	5.022	5.786	0.868	0.398	-7.185	17.229
<i>NEPE</i>	0.153	0.084	1.827	0.085	-0.024	0.331
<i>LSE</i>	0.048	0.099	0.481	0.637	-0.161	0.257
<i>CSE</i>	-0.149	0.133	-1.119	0.279	-0.430	0.132
<i>HE</i>	0.386	0.141	2.740	0.014	0.089	0.683

We decided to include the mentioned model in the study despite the fact that the F-test results indicate that it is not statistically significant (Table 5). However, p-value of individual regression coefficient for unemployed with higher education points out in its statistical significance.

4 Conclusion

Crime rate is influenced by many factors in individual countries. Poverty level, unemployment, strict police enforcement, severe sentences, age of income level belong among the frequently investigated impact factors. The current state of the Slovak economy is influenced by a inflation, impacts of pandemic and also war conflict in Ukraine and energy crisis. The impact of these phenomena was reflected in the development of unemployment and poverty indicators. In case of unemployment, there was a significant year-on-year increase in the number of unemployed and long-term unemployed (the period of 2019 and 2020) caused by pandemic.

Currently, due to high inflation, the population strongly felt the drop in real wages, which brought many households closer to the poverty line. It resulted in the highest number of people living below the poverty line (13.7% of the population) in Slovakia. Several residents face even existential problems that change their behavior, which in the worst case can result in committing criminal activity.

Correlation analysis confirmed a very strong relationship between crime and unemployment, while the value of the correlation coefficient was even higher in the case of long-term unemployment. These results are consistent with many studies, such as Jawadi et al. 2021; Armin, 2019; Shah, Soomro, Mirjat, 2019; Nordina, Almena, 2017; Fadaei-Tehrani, Green, 2002.

For a better assessment of the impact of unemployment on crime, we expanded the analysis to include the factor of education of the unemployed. The lack of education makes it difficult for low-income people to meet their needs. This was also confirmed by the results we achieved. The relationship between unemployed with no education or primary education and general criminality proved to be statistically significant. The second regression model indicated the relationship between economic crime and individual levels of education of the unemployed, specifically in the case of the unemployed with higher education.

In the article, we focused on the investigation of the relationship between crime, unemployment and poverty, thus fulfilling its aim. For further research, it is possible to expand the selection of considered factors, e.g. about income indicators, living standard or welfare.

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ANALYSIS OF CRISIS INTERVENTION OF HELPING PROFESSIONALS IN TIME OF WAR CONFLICT

^aSOŇA ŠROBÁROVÁ, ^bJANKA BURSOVÁ

^{a,b} *Academy of the Armed Forces, MRŠtefánika, Demänová 393, Liptovský Mikuláš, 031 01, Slovakia Catholic University of Ružomberok, Institute of theology, Spišské Podhradie, Hrabovská cesta 1A, Ružomberok, 034 01 Slovakia*
 e-mail: ^asona.srobarova@ku.sk, ^bjanka.bursova@ku.sk

Abstract: In the current period of military conflict, helping professions of any kind are exposed to an excessive burden, even a crisis. In a military conflict, it is extremely important to have social support and psycho-social care available. Crisis intervention implemented for helping professionals such as firefighters, rescue services, psychologists, social workers and volunteers is implemented in areas of acute crisis situations and is also possible through telephone and online forms of assistance. The primary goal of the conducted research was to find out among the respondents - helping professionals, the use of crisis intervention services at the time of military conflict, to clarify what needs are priority for the respondents at this time, the type of psycho-social problems with which they turn to crisis intervention. The survey, which was methodologically oriented towards quantity, was carried out in the form of an anonymous questionnaire, which was only available in electronic form via a google form, and respondents were approached on primary internal networks. The questionnaire was filled out by 291 helping professionals - respondents. On the basis of the processed data, the crisis form of assistance appears to be a sought-after option, but the online and remote form of providing crisis intervention is a less sought-after option in solving psycho-social problems in times of military conflict. The recommendation is to support and promote the distance form of aid more, taking into account the fact that the number of the mentioned crisis situations remained unsolved by the respondents..

Keywords: war conflict, crisis aid, crisis intervention aid, psycho-social problems, professional helper

1 Introduction

In connection with the current military conflict in Ukraine, we encounter daily information about new war attacks, deaths, and measures taken. It is not easy to keep a cool head, as evidenced by many examples of irrational reactions and behavior of people. In times of war and with the associated mission of a professional helping professional, we struggle not only with information, but also try to control and manage fear, concerns and consequences, or the obligations that are imposed on professional help.

If we talk about a crisis situation, we must first define what we actually mean by this. According to the Constitutional Act No. 227/2002 Coll., a crisis situation is defined as a period during which the security of the state is immediately threatened or disturbed, and the constitutional authorities may declare war, declare a state of war or a state of emergency after meeting the conditions established in this constitutional act to resolve it, or emergency. Act No. 387/2002 Coll. on managing the state in crisis situations outside of wartime and martial law deals with it similarly – without martial law and war. On the basis of this law, special departments were created in individual ministries, which manage, among other things, the field of crisis management (by the way, the crisis staff of the Ministry of Agriculture also dealt with the crisis when gas supplies stopped, now also the Ministry of Foreign Affairs attempt to hijack a ship by pirates, etc.).

Vodáčková (2002) describes the disasters caused by two destructive forces, nature and man. According to the WHO classification of disasters, it is possible to recognize the following types in abbreviated form:

1. Natural climatic disasters:

- earthquake and its consequences - landslides, fires, epidemics, famine,
- volcanic activity and its consequences - mud, volcanic lava, volcanic floods,
- movements of water or earth - floods, landslides, avalanches and their consequences,
- weather effects – excessive droughts and heat, frost, windstorms, hail, torrential rains and their consequences.

2. Disasters caused by human activity (socio-economic):

- war conflict and emergency situations of a military-political nature in peacetime (terrorism, nationalist conflicts, migration waves),
- civilizational disasters – accidents in the area of water structures, transport and industrial accidents, toxic waste and nuclear energy accidents and large fires.

Matoušek (2013) explains that all these influences bring and leave visible traces on the environment, nature, but most of all in the memory and soul of man. These shocking events have their own characteristics and consequences:

- they happen suddenly and it is impossible to prepare for them,
- they bring feelings of fear, helplessness, inability to confront and change circumstances and situations,
- disturbs the "feeling of invulnerability",
- feeling of helplessness, inability to control and change circumstances and situations, it causes a strong experience of a threat to one's own life - in connection with an injury or with some great material loss.

The persons affected by this event may be direct victims (primary), namely direct participants of the calamity, who were exposed to its effects to the maximum extent, in this case war. We consider persons such as relatives and friends of primary victims to be secondary victims. Another category is rescuers and helping workers - resuscitation and therapeutic staff and other experts who provided professional help or participated in this event in some way, this category also includes professional helping professionals and volunteers. Another group is the inhabitants of the place where this event took place.

All participants - direct and indirect victims and residents of the place where the war is taking place - it is necessary to pay increased attention to the risk groups affected by the events.

Every person, under certain life circumstances, can get into a crisis situation, when they are in a state of destabilization on a psychological and social level. External events such as natural and technological disasters, armed conflicts, kidnappings, and violence in cities are frequent triggers of the crisis. In addition to external circumstances, a crisis can also be associated with situations in which an individual's life, home, property or well-being are threatened (Sá, Werlang, Paranhos, 2008; Dudek et al., 2018).

The experienced crisis can also affect a person's health, when he starts to feel clinical symptoms and needs help from the outside. (Silva, Siegmund, Bredemeier, 2015; Rochovská et al., 2019).). In such situations, quick, targeted, professional and available help is important. The solution is the provision of crisis assistance, which in Slovakia is regulated by the Social Services Act 448/2008 Coll., which defines social assistance as "a social service provided to a natural person who is in a crisis social situation or in another difficult life situation that he cannot solve on his own and is ensured mainly by providing social counseling" (Act on Social Services 448/2008, § 53).

2 Crisis intervention techniques and humanitarian aid

Timely intervention in crisis intervention in the event of a mass disaster remains paramount. This is short-term psychosocial help after traumatic events, which is also associated with a synonym such as debriefing. Included in this early intervention are terms that explain the meaning of:

- demobilization - which means a reduction in military alertness,

- debriefing – means to file a report,
- defusing - in translation means to rid the situation of explosiveness.

In her publication, Vodáčková (2002) explains the terms defusing means to rid the situation of explosiveness. Another term is debriefing - which in translation means- file a report. The mentioned terms describe two stages of the crisis-intervention technique for coping with a traumatic event (mostly with a mass disaster situation). They are used for all types of victims. They can be used individually, but they are mostly used for working with a group. It is usually the task of the intervention commander to keep in mind the goal of defusing, which is to create an atmosphere of support and well-being and also to strengthen team feeling.

The reason for starting the mentioned methods in the eighties of the 20th century was the discovery that the victims of disasters are surprised by their own feelings, which they did not know until now. Those who survived these difficult situations were afraid of going crazy. Many of them felt fear and shame, and the reactions of those around them hurt and shamed them even more. Another reason for the creation of techniques was concern about the performance and mental well-being of rescuers. Many of them became victims of alcohol or drug addiction after several years of service. Therefore, it was necessary to introduce a method that would help individual groups of victims to cope with (mass) misfortune. It turned out that immediately after the event, or later.

The intervention, it is good to clean up the situation, rid it of explosiveness. Defusing is considered an essential part of the rescue workflow. Crisis intervention techniques are characterized by these terms applied during the resolution of complications brought about by these extremely unexpected events. Mitchell and Evely (in Baštecká 2005) recognize the following points of the crisis continuum of early crisis assistance:

- pre-crisis preparation,
- demobilization,
- stress management instruction,
- defusing
- debriefing of stress stemming from a crisis event,
- crisis intervention with individuals,
- family coping with the burden arising from an extraordinary event,
- consulting for organizations and the community,
- pastoral crisis intervention,
- follow-up – making follow-up care available.

Debriefing is most likely to be effective if it is included as one part of the entire crisis intervention complex, what it means material and humanitarian aid.

Baštecká (2005) says humanitarian intervention as a system of activities aimed at saving innocent lives and also at alleviating human shortages exacerbated by famine, earthquakes, floods and other impacts. This aid is implemented in conditions when a large number of people are at risk, namely in the event of a mass disaster and large-scale disasters, as well as when security and international peace are threatened.

The focus of humanitarian aid is the needs of the victims, no person must be discriminated against. The method of assistance must correspond to basic human rights, which are also enshrined in the Charter of the United Nations. Material aid is humanitarian if its method is humanitarian and it is provided to all who need it. One of the forms of humanitarian aid in non-governmental non-profit organizations, either independently or in cooperation with the state administration, is the provision of spiritual, psychological, material and financial assistance. Nowadays, all the principles of humanitarian aid are being questioned. The only thing that remains unquestioned for now is the idea of human needs and mercy.

Psychosocial assistance provided by professional helping professionals consists of actions carried out by the organization towards requirements whose origin is psychological (affecting the feelings, behavior, thinking and coping resources of the individual) or social (concerning above all the support necessary for the person to cope with the generated load). The action of a helping person who makes an effort to help the psychological and social needs of victims describes the concrete definition of psychosocial assistance.

The given program and crisis strategies for helping persons threatened by military conflict and related trauma for the disabled require:

- space for rest and pause,
- safe environment,
- prevention of stigmatization,
- space for expressing unwanted emotions,
- support of self-help groups,
- recording and perception of circumstances from the time before the disaster, which can worsen the process of coping with the trauma,
- to allow victims to regain self-esteem and a sense of control over their own lives and to provide an opportunity to reassess life goals.

The most important goal of psychosocial assistance is to integrate people into the community so that they are as independent as possible.

Pavlůvčinová (2011, p. 298-299) explains that "an important prerequisite for helping is the creation of a network of psychosocial help. By psychosocial network we mean the connection of various entities that help people solve difficult life situations. Help is more effective the smaller the territory on which the team operates and the more diverse is. This increases its flexibility, which is a valuable characteristic of the team in relation to various major events."

3 Data and methodology

In order for crisis intervention for helping professionals to be helpful, it is necessary to ask for it and look for it. The primary goal of the research carried out in 2022 in November/December was to find out the respondents' use of face-to-face and remote form of crisis intervention services during their assistance on the border with Ukraine during the conflict; the type of social problems with which they turn to crisis intervention and also knowledge of the types of crisis assistance. We carried out a quantitative survey in the form of an anonymous questionnaire, which was only available in electronic form via a google form, and respondents were approached via their sending organization. The questionnaire was filled out by 291 respondents - helping professionals. The answers we received from the respondents through an electronic questionnaire, we gradually evaluated descriptively as well as using the SPSS program. Out of the total number of 291 respondents, 88% are men and 12% are women, which in numbers means 251 men and 41 women. We divided the age scale into five groups according to the age of the respondents. The largest group consisted of respondents aged 29-56. The respondents come from voluntary organizations in the number of 194, which is 56%, and helping professionals such as firefighters, psychologists, crisis interventionists, social workers, soldiers 44%, i.e. 97 respondents. Based on the research objective, we processed five research questions: The largest group consisted of respondents aged 29-56. The respondents come from voluntary organizations in the number of 194, which is 56%, and helping professionals such as firefighters, psychologists, crisis interventionists, social workers, soldiers 44%, i.e. 97 respondents. Based on the research objective, we processed five research questions: The largest group consisted of respondents aged 29-56. The respondents come from voluntary organizations in the number of 194, which is 56%, and helping professionals such as firefighters, psychologists, crisis interventionists, social workers, soldiers 44%, i.e. 97 respondents. Based on the research objective, we processed five research questions:

VO1: Is there a statistical difference among the respondents between the perception of social problems in men and women at the time of the military conflict when helping people fleeing the war conflict in Ukraine?

VO2: Is there a difference between the needs of men and women at the time of military conflict?

VO3: Did the helping respondents use the program at the time of helping refugees at the border as part of a remote form of crisis intervention?

VO4: Did the respondents use the help of crisis intervention during the war conflict to help refugees?

With questions VO1-VO4, we investigated respondents' use of face-to-face and remote form of crisis intervention services; types of social problems during wartime conflict and the use of crisis intervention services in wartime conflict.

VO1: Is there a difference among the respondents between the perception of social problems in men and women at the time of the military conflict when helping people fleeing the war conflict in Ukraine?

We asked the respondents in the form of a closed question about their most pressing problem at the time of border assistance for persons fleeing the war on the borders of Slovakia and Ukraine. We categorized the answers into thirteen groups.

Table 1: Area of problems related to border assistance at the time of the outbreak of war in Ukraine

Variables	Men			Women			Total		
	M	N	SD	M	N	SD	M	N	SD
An increase in fear for oneself	0.21	29	0.62	0.21	244	0.58	0.21	273	0.59
An increase in the feeling of unhappiness	0.34	29	0.72	0.40	244	0.74	0.40	273	0.74
Increased feeling of loneliness	0.34	29	0.77	0.55	244	0.84	0.53	273	0.84
Greater sadness	0.59	29	0.87	0.77	244	0.93	0.75	273	0.93
An increase in hopelessness	0.21	29	0.49	0.39	244	0.73	0.37	273	0.71
Loss of certainty	1.28	29	0.96	1.31	244	0.91	1.31	273	0.91
Fear of the future	0.93	29	0.88	0.84	244	0.94	0.85	273	0.94
Increase in aggression	0.48	29	0.87	0.55	244	0.86	0.55	273	0.86
Increased feeling of isolation	0.59	29	0.91	0.93	244	0.97	0.89	273	0.97
An increase in fear for your family	0.28	29	0.65	0.35	244	0.70	0.34	273	0.70
Greater fear for loved ones	0.69	29	0.89	0.68	244	0.88	0.68	273	0.88
Change in eating habits (more or less food)	1.21	29	0.98	1.45	244	0.88	1.42	273	0.89
Change in sleep mode	1.14	29	0.92	1.11	244	0.95	1.11	273	0.94

Table 2: The area of most pressing problems for the respondents at the time of the military conflict.

Variables	N	Mean Rank	U	mr	
Deterioration of health	Men	29	134.64	3469.5	0.766
	Women	244	137.28		
Increase in aggression	Men	29	132.12	3396.5	0.640
	Women	244	137.58		
An increase in fear for oneself	Men	29	120.93	3072.0	0.151
	Women	244	138.91		
Greater sadness	Men	29	125.14	3194.0	0.328
	Women	244	138.41		
An increase in hopelessness	Men	29	126.05	3220.5	0.289
	Women	244	138.30		
n increase in fear for your family	Men	29	135.55	3496.0	0.903

Fear for livelihood	Women	244	137.17	3329.0	0.562
	Men	29	144.21		
Increased feeling of loneliness	Men	29	130.50	3349.5	0.560
	Women	244	137.77		
Increased feeling of isolation	Men	29	114.60	2888.5	0.068
	Women	244	139.66		
An increase in the feeling of unhappiness	Men	29	131.07	3366.0	0.551
	Women	244	137.70		
Loss of certainty	Men	29	137.57	3521.5	0.963
	Women	244	136.93		
Fear for a family member	Men	29	121.79	3097.0	0.171
	Women	244	138.81		
Fear of financial security	Men	29	138.55	3493.0	0.901
	Women	244	136.82		
Greater fear of the death of a loved one	Men	2	139.71	3459.5	0.825
	Women	244	136.68		
Change in eating habits (more or less food)	Men	29	125.88	3215.5	0.333
	Women	244	138.32		
Change in sleep mode	Men	29	131.91	3390.5	0.641
	Women	244	137.60		

There is no statistically significant difference between men and women in these variables.

A higher M score represents a greater measure of the variable. Out of 291 respondents, up to 273 respondents stated the most pressing problems that afflict them at the time of border assistance in Ukraine. Respondents could choose more than one answer. According to Table 1, it can be concluded that the most agree with the statements about the increase in fear for oneself, which was stated by 29 men (11%) and 244 women (89%). An increase in the feeling of danger was also reported by 29 men (11%) and 244 women (89%).

Table 3: How important are psychological and social needs

Gender	N	Mean Rank	U	mr	
How important are physiological needs to you when helping people during a war conflict? – breathing, sleep, nutrition...	Women	29	100.45	2478.0	0.001
	Men	244	141.34		
How important are psychological needs to you at the time of helping people during a war conflict? – love, happiness, knowledge....	Women	29	104.78	2603.5	0.000
	Men	244	140.83		
How important are social needs to you at the time of helping people during a war conflict? – feeling of safety and security, communication....	Women	29	133.14	3322.0	0.854
	Men	244	135.77		

VO2: Is there a difference between the needs of men and women in helping refugees during wartime?

We were interested in how the respondents perceive the needs at the time of military conflict and which are more prioritized for them. Also, whether a significant share in the individual needs of men and women is demonstrated.

Table 4: Significant results in individual needs

Gender	Men			Women			Total		
	M	N	SD	M	N	SD	M	N	SD
How important are physiological needs to you when helping people during a war conflict? – breathing, sleep, nutrition...	4.10	29	1.05	4.63	244	0.77	4.58	273	0.82
How important are psychological needs to you at the time of helping people during a war conflict? – love, happiness, knowledge....	4.34	29	0.90	4.74	244	0.73	4.70	273	0.76
How important are social needs to you at the time of helping people during a war conflict? – feeling of safety and security, communication....	3.21	28	1.60	3.15	242	1.90	3.16	270	1.87

For the majority of respondents, 29 men and 244 women, physiological and psychological needs are more important than social ones.

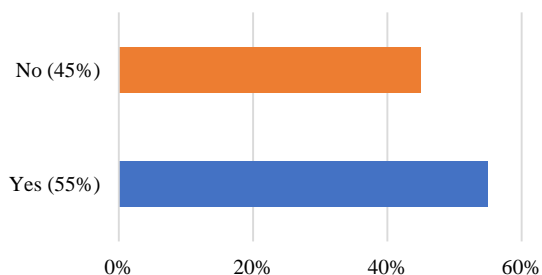
The essential value is the modality of the average or M, on the basis of which we can compare the measure of a specific variable that individual groups had.

We can already state that there is a difference, eg the values of M in the second variable between men and women differ by approx. 0.4 points. Which on a scale of 1-5 is quite a big difference. We evaluated this research question based on the inference table and the Mann-Whitney U test of differences. This test determines whether the difference between the groups is statistically significant or negligible. The essential indicator is the Mean Rank or the average of the ordinal numbers, the decisive value is the p value, on the basis of which we know that the difference is not significant. Based on this test, a statistically significant difference between men and women was found in the first and second variables. In both variables, women had significantly higher average values.

VO3: Did the respondents use the helping program at the time of helping people during the war conflict as part of the remote form of crisis intervention?

We were interested in whether the respondents used crisis help lines or other remote crisis intervention assistance.

Chart 1: Knowledge about the distance form of crisis intervention

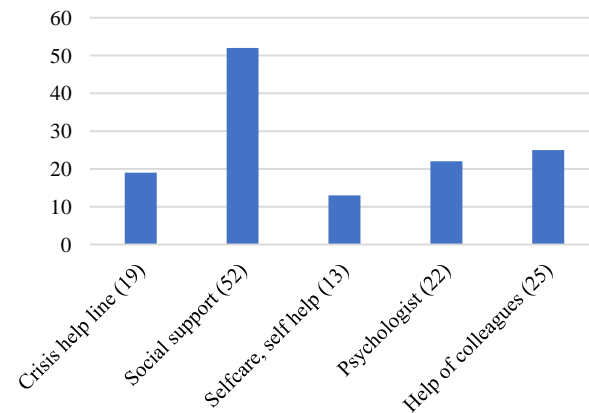


Only 55% of all interviewees did not use the remote form of crisis assistance at the time of helping persons during the war conflict, on the contrary, 45% of the interviewees did use it. Out of 291 respondents, 160 respondents did not use it, while 131 respondents used distance form crisis intervention programs.

VO4: Did the respondents use the help of crisis intervention during the war conflict to help refugees?

We asked question VO4 in order to find out whether the respondents know specific forms of self-help. Respondents could choose one of the options in the semi-structured question or add a free answer.

Chart 2: Knowledge of helplines



From the data shown in graph 2, we can see that most respondents use social support from loved ones as part of their self-help coping with the crisis namely 131 respondents, 52 use the help of colleagues, 25 respondents use a military psychologist, 22 respondents use the crisis helpline and 19 use self-help.

4 Conclusion

Just as crisis intervention has its justification in the civilian sector, we must not forget its importance in the military environment as well. Those helping as an integration rescue team are often participants in traumatic, demanding, life-threatening situations that can result in various psychological disorders. Based on these features of the military environment, it is essential to emphasize the psychological preparedness of the assisting units and especially the preparedness of the commanding units.

Management plays the most important role in crisis situations. He must be aware that he is responsible for the physical and psychological condition of the helpers. This responsibility also brings with it the knowledge of certain methods and procedures of the commander, in the event that the rescue and assisting team is confronted with a traumatic event. After extreme situations, professional helpers tend to undergo stress reactions. Stress reactions after traumatic events are different. Mostly they can appear immediately or they will show up after a certain time. If the commander of a military unit has sufficient knowledge about possible help and support after a traumatic event, he can limit stress reactions by his actions. As part of psychological support in military conditions, we divide three levels of support. The first level, which is based on the mutual support of the members of the unit, is considered the most effective help immediately after a traumatic event. The second and third levels of intervention include more formal assistance, which is carried out by professionals in the field of psychological support. The appropriate use of support levels depends on specific situations. The commander must be able to judge for himself, what level is most effective for its members after a traumatic event. However, it is not a rule that psychological support levels are the only intervention in crisis situations.

Other methods are also used in the military environment. One of them is the debriefing method, otherwise known as a group session. In this case, it is not a classic meeting, it is more about confiding, sharing your thoughts, feelings, fears with your colleagues. Debriefing allows the helper to regain his balance, confidence in his own strength and himself after a traumatic

event. otherwise known. In this case, it is not a classic meeting, it is more about confiding, sharing your thoughts, feelings, fears with your colleagues. Debriefing allows the helper to regain his balance, confidence in his own strength and himself after a traumatic event. otherwise known as a group session. In this case, it is not a classic meeting, it is more about confiding, sharing your thoughts, feelings, fears with your colleagues. Debriefing allows the helper to regain his balance, confidence in his own strength and himself after a traumatic event.

Psychological crisis intervention also has its place within the helping professions. As we have already mentioned, each of the professions helping professionals has the opportunity to seek help within their department due to the nature of their profession, in which they are often exposed to various demanding influences.

Providing psychological crisis intervention is an integral part of all helping professions. However, when analyzing the current state of crisis intervention in the various helping components of the Slovak Republic, we encountered one shortcoming. Within the Slovak Republic, there is no comprehensive document, directive, or regulation that would regulate a uniform procedure for its provision. The management body itself is responsible for providing psychological crisis intervention within its department. Due to the absence of a document that would regulate the procedure for providing crisis intervention to the helping components, it is justified to reflect on this fact.

The goal of crisis interventions is to use specific methods to positively influence the readiness of those helping, but also their entire grouping, such as units in crisis situations, with the aim of restoring their psychological readiness to perform tasks and preventing long-term consequences for their psychological health. At the same time, the tasks of crisis interventions are to act in the direction of restoring cohesion, psychological readiness and psychological health in units that are victims or rescuers in crisis situations. The intervention creates conditions for the regeneration of the psychological and physical strength of groups and individuals, focuses on improving the quality of communication, and tries to reduce psychological tension, worries and fear. The tasks of the intervention are also aimed at assessing whether individuals and groups are psychologically prepared for further action in a critical situation, or whether they need to be replaced.

Based on all the acquired information, we came to the conclusion that the creation and subsequent introduction of the directive is necessary for the effective implementation of psychological crisis intervention.

Workers at all levels of crisis assistance, whether they provide assistance regulated by law or a psychosocial intervention team, as well as professional soldiers participating in rescue work or victim support, experience considerable pressure. This attention should be directed in two directions:

- they should undergo professional training in all areas,
- they should participate in psycho-relaxation sessions that mental health workers can use to help themselves and others."

The members of the psychosocial intervention team were able to provide help correctly and professionally, their permanent education is important so that they can effectively help the victims, also the relatives of the victims, the residents of the place where the emergency occurred, and also themselves. They should pay special attention to risk groups of the population. This requires systematic and professional training. Professional soldiers at all levels of crisis assistance are witnesses of human tragedies, whether physical consequences, death of loved ones or anonymous people, damage to property and other losses in a person's life. Even those who help themselves can show physical or mental consequences of work overload over time due to the necessity of facing human suffering. They experience their feelings of physical exhaustion and are irritable. They experience

deep sadness from the event, and feel drawn into these issues. As a result, work performance is reduced, they have trouble concentrating and make decisions more difficult. It is therefore essential that they learn to prevent stress and, with the help of experts, learn to manage it.

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MUSICAL CHARACTERISTICS OF LE CHEMIN DE LA CROIX OP. 29 BY MARCEL DUPRÉ

^aMAREK ŠTRBÁK

Constantine the Philosopher University in Nitra
Tr. A. Hlinku 1, 949 01 Nitra, Slovak Republic
email: "mstrbak@ukf.sk"

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Abstract: The presented study focuses on the musical characterization of the organ work *Le Chemin de la Croix* Op. 29 by the French composer Marcel Dupré, which by its content, conception and scope occupies a unique and irreplaceable slot in the organ repertoire. This study introduces the composer of this work, as well as the author of the poem of the same name, Paul Claudel, and the circumstances of the composition's formation. Subsequently, all fourteen components of this organ cycle, i. e. the fourteen Stations of the Cross are analyzed from a musical point of view.

Keywords: Marcel Dupré, *Le Chemin de la Croix* Op. 29, organ, organ music, musical characteristics

1 Marcel Dupré

Marcel Jean-Jules Dupré was a prominent French organist, composer, teacher, musicologist and publisher. Most of his works form an integral part of the repertoire of many organ performers. His work as a composer as well as a teacher significantly influenced subsequent generations of not only French but also foreign organists.

He was born in 1860 in Rouen in northern France and inherited his musical talent from his parents. His father, a pupil of the famous French organist and composer Alexandre Guilmant, was a music teacher at the Lycée Corneille and organist at the church of Saint-Ouen in Rouen. His mother was a gifted pianist and a pupil of Aloys Klein. The art of organ improvisation impressed Marcel Dupré early in his childhood. At the age of eleven he became an organist at the church of Saint-Vivien in Rouen. Already at this age he was a frequent visitor to other churches in Rouen, where he improvised at vespers. When his father returned home on Sunday evenings, little Marcel was always confronted with questions about his improvisations - what keys he used, registration, forms, in which voices he led the theme, and so on. Each of the improvisations was subjected to a brief but rigorous analysis.¹

In 1902, Dupré began attending the Paris Conservatoire, where he became a pupil of Alexandre Guilmant and Charles-Marie Widor. There he won the Prix de Rome in 1914 with his cantata *Psyché*. Six years later he performed the complete organ works of Bach in ten concerts at his alma mater, and a year later he reprised the series at the Palais de Trocadéro. From 1926 to 1954 he taught organ at the Paris Conservatoire, and his pupils included future eminent figures in the art of organ performance, such as Marie-Claire Alain, Pierre Cochereau, Rolande Falcinelli, Jean Guillou, Jean Langlais, Gaston Litaize, Olivier Messiaen, Luigi Ferdinando Tagliavini and others. Dupré has composed approximately one hundred works for organ, piano, orchestra, choir or chamber ensembles, but the focus of his work is on organ compositions. Several of these - such as the 15 *Versets* Op. 18, the *Symphonie-Passion* Op. 23, or the *Chorale et Fugue* Op. 57 - were originally written in improvisation.²

Le chemin de la croix, Op. 29, which is his most extensive organ composition, is no exception. In his memoirs, Dupré mentions that for his First Communion he received, among other gifts, a beautiful Bible with illustrations by Gustave Doré, who was an important French painter, graphic artist and illustrator. One of Dupré's first compositions - the cantata *Le Songe de Jacob* - premiered by his father and his choir on the occasion of Marcel's fifteenth birthday, was directly inspired by scenes from this

Bible.³ How many other illustrated biblical scenes, not excluding the Stations of the Cross itself, had influenced Dupré in his early youth? Where do the beautiful imagery in his other program music come from? Perhaps it is here that we find a source of inspiration for *Le Chemin de la Croix*.

2 Sources of inspiration for the composition

The idea of combining poetry and organ improvisation was born with Madeleine Renaud-Thévenet, a well-known actress and professor at the Brussels Conservatoire. She proposed to recite Paul Claudel's Stations of the Cross in verse, with an improvised musical commentary after each stop. Dupré enthused the idea very much and, after discussing it with his spouses, decided to try out the idea at the Saint-Sulpice church in Paris. The success or failure was to be decided by Mrs Dupré and Mr Renaud. The experimental private concert was a promising success and preparations for the Brussels performance could begin. Dupré suggested that the poetry and music should last no longer than ninety minutes, and that the Stations of the Cross should be preceded by several chorale overtures by J. S. Bach. This dramaturgical plan and the musical performance itself were a great success in Brussels. Inspired by it, Dupré and his wife, on their return trip to Paris, agreed to write down and publish these improvisations in sheet music. The following year he performed his work at the Palais Trocadéro, but Claudel was not mentioned on this occasion, and it is uncertain whether his verses were performed at this concert.⁴

The themes for the Brussels improvisations were not chosen at random. They were created by Dupré himself, inspired by his study of an extraordinarily large repertoire of sacred music from the Renaissance to the 20th century. He took several musical symbols or motifs from the works of Schütz, Bach, Handel, Beethoven, Franck, Wagner and others, referring to this mode of composition as "traditional symbolism".

The details of Dupré's relationship to the text of the Stations of the Cross are unknown. Its author, Paul Claudel, was an important French poet, playwright, novelist and diplomat. Although he came from a Catholic family, he lost his faith during his school years. At the age of eighteen, he found it again thanks to a profound spiritual experience during the Christmas Vespers. This deep faith became the foundation and inspiration for his work, which includes some 4,000 pages of texts on the relationship between God and His creation, His mystery and His purposes. The *Way of the Cross* was written between 1911 and 1913, when Claudel returned to France after a thirteen-year sojourn in China. This text was of immense value to him. He wrote it from the bottom of his heart, with the intention of expressing his fervor and religious zeal to the best of his ability. He wished this meditation on the Passion of Jesus to be read during the devotions of the Stations of the Cross or jointly with other prayers. The text is also a contemplation on sin and the fate of every man who bears his cross in ordinary life. The combination of Claudel's text and Dupré's music has created a concrete and realistic rendering of a story that is inherently violent and terrible, yet filled with tenderness and trust.⁵

The two main characters in Claudel's *The Way of the Cross* are Jesus and his mother. At the beginning we are confronted with Pilate's condemnation of Christ to death as he accepts the cross and struggles to drag it to Calvary. Along the way he falls three times, encountering his Mother, Simon of Cyrene helping him with the burden of the cross, and Veronica with a clean towel. Last, he instructs several weeping women. Dupré masterfully describes musically, even shares, the agonies and sufferings of the Saviour right up to the Crucifixion itself. As Jesus' body is laid in the tomb, the composer's deep faith is palpable in the

³ DUPRÉ, M. 1981. *Erinnerungen*. Berlin : Merseburger Verlag, 1981. p. 42.

⁴ STEED, G. 1999. *The Organ Works of Marcel Dupré*. Hillsdale : Pendragon Press, 1999. p. 92 - 94.

⁵ STEED, G. 1999. *The Organ Works of Marcel Dupré*. Hillsdale : Pendragon Press, 1999. p. 95.

¹ DUPRÉ, M. 1981. *Erinnerungen*. Berlin : Merseburger Verlag, 1981. p. 35.

² STEED, G. 1999. *The Organ Works of Marcel Dupré*. Hillsdale : Pendragon Press, 1981. p. 147 - 152.

music. Mary appears at the fourth stop, and her presence is prominent later in the piece. The conclusion of the tenth stop is a reminiscence of the incarnation, and Jesus' mother is present even at his death. She holds her Son's body after it is taken down from the cross and sees it being laid in the tomb. Each of the fourteen sections is full of human and spiritual drama. Dupré's use of twelve melodic and six rhythmic themes or leitmotifs was sufficient to portray it.⁶

3 Musical characteristics of the composition

The first part of *Jésus est condamné à mort* (Jesus is condemned to death) is, together with the third and ninth, perhaps the most dramatic part of the whole cycle. This movement begins with a melody played on the register of the *Trompette 8'*, which symbolizes Pilate's washing of his hands over the fate of Christ. In the fourth bar, marked *Agitato*, a motoric movement in eighth notes begins and gradually graduates. Here the composer has masterfully conveyed the gradual build-up of the restlessness and aggression of the assembled crowd, which is continuously echoed by cries of "Barabbas, Barabbas", composed as an empty triple-note composed of a pure fifth and a pure octave. These are echoed in the upper position (in the case of women?) as well as in the lower (in the case of men?). The gradual addition of registers, moving from a sonically weaker to a stronger manual, and the constant layering of musical material characterizes an increasingly frenzied mass that allows itself to be influenced by a few shakers. The highlight is Pilate's judgement itself at bar 102 - the most powerful and brutal chord of the entire movement. After its sounding there is a gradual calming down - the crowd has achieved what it desired and slowly disperses. From the distance, the call of "Barabbas" is heard three more times in a deep position, backed by the *Basson 16'* register. The whole drama dissolves in the *pianissimo* of the last repeated motif, which is composed of three eighth notes. The last solo short deep notes in the pedal are only a dim memory of the previous tense musical progression.

In the second movement, *Jésus est chargé de la Croix* (Jesus receives his Cross) begins the slow and difficult journey to Calvary. The opening motif, composed of sixteenth- and eighth note dotted notes, recalls the stumbling feet of Jesus and interweaves through each bar, whether in the left hand, right hand, or pedal. Its counterpoint of sorts is the cross motif - a descending pure fifth that is heard on the third manual on the tonguing register. This motif is also treated canonically (e.g. in bars 5-7, 21-23 etc.) In bar ten Dupré extends the cross motif to a rising major second and two pure fifths. It is the motif thus constructed that can be seen as "lifting" the cross onto Jesus' shoulders - its heaviness is emphasized by the fact that it is also treated canonically - for he accepts the cross not only "for himself" but also for all sinful humanity. The gloomy, dark tone of the movement is emphasized by the slow tempo marking *Lento, pesante*. In bars 32-35 we find an interesting combination of all three motifs of the movement. However, the "lifting of the cross" gradually fades away - for the cross has already "found its place" on Jesus' shoulders. The last deep B note in the pedal on the register of *Soubasse 32'* can be seen as the immense depth of Christ's suffering and at the same time a symbol of the death that is slowly but surely approaching.

During the third part of *Jésus tombe sous le poids de sa Croix* (Jesus falls the first time), we watch the Saviour as weakness and weariness take hold of him. While the quarter notes in the left hand and the pedal with occasional quarter dashes depict the irregular stride of Jesus, the relentless and continuous eighth-note withdrawals are reminiscent of marching soldiers in full armour, urging the condemned man on mercilessly. The first half of the third stop is a continuous escalation from *piano* to *tutti*. In bar 12 a new melancholy theme is heard, symbolizing pain and suffering. It is interesting, however, that during it Jesus' footsteps disappear - as if he has stopped despite the soldiers marching on. After eight bars, they all start marching again and

the momentum continues to build. At bar 35, Jesus' footsteps stop again and the theme of pain and suffering is heard again. This time Jesus stands for ten bars. From bar 45 the soldiers force him to take more intermittent steps, but it doesn't last long - Jesus doesn't even fall, perhaps, he just slumps to the ground in complete silence at bar 51, where there is only a dash of *fermata*. The soldiers have unequivocally stopped as well. After this moment comes only the melody of some distant lament on the register *Gamba 8'* and a kind of "echo" of the whole movement in the last four chords, broken by dashes.

The fourth part, *Jésus rencontre sa mère* (Jesus meets his mother), shows the Mother in pain in the flute solo. Her "song" is accompanied by quiet chords and the movement of the eighth notes of the left hand on the quiet register *Voix célestes 8'*. The theme of the Mother consists of one straightforward long note followed by a simple downward decomposition of a major fifth chord. Later in the course, the theme is enriched by the motif of a certain question in the form of a rising third. One can tell that there are no tears in the Mother's eyes, no expression on her face, only a silent mouth. This grief is too deep for tears. (This same music is heard in the thirteenth station, when the Mother holds the limp body of her Son in her arms.) The poignant expression and transcendence of the musical content of this movement are indescribable in words. Dupré's combination of simple melody, quiet registration, and harmony in the accompanying voices achieves an outright mystical atmosphere where time stands still and the listener is lost in the moment.

The fifth part, *Simon le Cyrénéen aide Jésus à porter sa Croix* (Simon the Cyrene helps Jesus to carry the Cross), brings a change of atmosphere. The pastoral music highlights the rural origins of Simon, who on his way to the city unexpectedly becomes a direct participant in the events of the day. A melody on the *Trompette 8'* register echoes in the pedal to the simple accompaniment. This motif is familiar to us, heard already in the second part but in reverse. Whereas then the major second and the two pure fifths were rising (the cross was lifted onto Jesus' shoulders), here they sound like a descending melody as the cross weighs Jesus down immensely, pressing him to the ground with its weight. The first two times the melody is heard from the key e¹, but the third time it is a semitone lower from es¹. Jesus truly cannot stand, and the soldiers seek help from the accompanying crowd. They pull out a random passer-by, Simon of Cyrene. He finds it hard to carry the cross with Jesus and cannot seem to match his stride. This is illustrated from bar 29 onwards, when fragments of the theme echo first in the upper position for Jesus and then in the lower position for Simon. The theme of the cross is heard in the canon later in the movement - as if Jesus had walked a little earlier and Simon had merely followed him. It is only in bar 63 that their theme is heard in unison - they have managed to find a common rhythm and are walking in unison. After three notes of the theme, they both sound the notes D (Jesus) and d¹ (Simon). Interestingly, at bar 79 the "Jesus tone" stops sounding and only Simon's is heard - the cross remains on his shoulders for a time.

In the sixth part, *Une femme pieuse essuie la face de Jésus* (Jesus and Veronica), Veronica comes to Jesus from the group of women to wipe his brow. In the left hand there is a simple two-part accompaniment composed on the principle of imitation, while a similar imitation is heard in the solo in the right hand, which is registered on the sound of *Hautbois 8'* and *Flûte 4'*. The solo voice is essentially a duet in which the lower voice imitates the upper voice, in a sense mirroring its accompaniment. In bars 21-23 and 27-30, the now familiar symbol of the cross is heard in the solo pedal - a descending major second followed by two pure fifths. At this point, Jesus' footsteps stop. Dupré's combination of simple melody, quiet registration, and harmony in the accompanying voices achieves an outright mystical atmosphere where time stands still and the listener is lost in the moment. The wiping of the face is symbolized by a rising or falling three-note compassion motif, which graphically or also when played acts as a "wiping" motion. In bar 35, Dupré interestingly transfers the "wiping" to the left hand accompaniment, and the motif from the beginning of the

⁶ STEED, G. 1999. *The Organ Works of Marcel Dupré*. Hillsdale: Pendragon Press, 1999. p. 98 - 100.

movement is heard again in the solo. In bars 48 - 50 and 53 - 54, the cross symbol is heard again in the pedal solo. After its second introduction, only a calm melody consisting of a four-note motif appears, sounding in "heavenly calm" on the register *Voix célestes* 8'. The deeper meaning of this part are both compassion and courage. Veronica is able to come to Christ, to touch him, to wipe away his sweat and blood, to find peace of soul and to try to share it with the Saviour.

After the previous intermezzo of calm comes the dramatic seventh movement *Jésus tombe à terre pour la deuxième tombe* (Jesus falls a second time). The second fall occurs almost unnoticed. This halt is closely linked to the third part. In the pedal, Christ's uncertain and pawing footsteps again appear, accompanied by the soldiers' unrelenting rhythmic stride, this time much more insistent by virtue of the added sixteenth-note values. Dupré's addition of all the mixtures achieved an unusual sound effect, where the brass clanking of the Roman soldiers' armour is heard throughout. The crowd presses in on the condemned from all sides and the burden of the cross becomes unbearable. Unlike the third part, the melancholy theme of pain and suffering is not heard here - no one makes Jesus stop. The cruel pain of the scene is heightened by the increasingly terrible dissonant chords. In bar 47 Christ descends unnoticed to the ground - this is depicted in slow descending two-note motifs. The soldiers' step is lost in *pianissimo*. Did Dupré mean to imply a loss of consciousness in Jesus? We don't know. The second fall concludes the first half of the cycle.

The eighth part, *Jésus console les filles d'Israël qui le suivent* (Jesus comforts the women of Jerusalem), is a beautiful musical evocation of the pity and compassion of those who accompany the condemned and see both pain and suffering. The cantilena, with its theme of pity, is one of the most urgent melodies of the whole work, but it always remains a part of the accompaniment and comes across as pastoral, even trivial. For the weeping women fail to grasp the higher meaning of Christ's sacrifice; in their simplicity they feel only sorrow and deep regret. Jesus' words of admonition and consolation come as a solo in tenor position on the *Trompette* 8' register. One can see some affinity with the Mother theme here - Jesus also begins with a decomposition of a "pure" major fifth chord, but unlike the Mother, the first two notes ascend, and are thus a kind of invocation. Despite Jesus' best efforts, the women do not accept the consolation; their frenzied accompaniment dies down only at the end, when Jesus runs out of strength and his "singing" ends on a long-held note. Once again, Dupré masterfully links two seemingly unrelated worlds - the ordinary, humble and fervent grief of a simple man confronted with God's wisdom, kindness and peace.

The ninth part, *Jésus tombe pour la troisième fois* (Jesus falls a third time), of Jesus falling a third time at the foot of the cross, depicts a crowd that, irritated by the slow pace of Jesus' steps, begins to bay for blood and spew insults. This section is the most technically demanding, fast-paced and dramatic of the entire cycle. Jesus' uncertain footsteps are again in the pedal, but there are not many more of them and they become increasingly unrhythmic, punctuated by longer pauses. The drama unfolds primarily in fast seven-note motifs in sixteenth notes and three-note descending motifs in eighth notes in the left hand. The madness of the crowd escalates sequentially, reaching an unbearable level, and, along with the soldiers, brutally forcing Jesus to walk on. The terrifying climax of the movement comes at bar 118 - in the organ *tutti*, the march of the soldiers breaks into deafening octaves in the pedal, with harsh dissonant chords sounding in the left hand, supported by frenzied fast figurations in the right hand. The final and definitive fall at the execution site comes suddenly in bar 158 and is literally devastating. Jesus collapses to the ground and an agonised silence ensues. This is followed by a brief moment of exhalation on the fundamental registers before the final humiliation. The fragments of some sighs resemble only the transmitted fragments of words spoken in a whisper.

In the tenth part, *Jésus est dépouillé de ses vêtements* (Jesus is stripped of his clothes) and the Roman soldiers roll dice against his garments. Jesus awaits his end. The movement is built on a short three-note motif consisting of a descending pure fifth and a rising minor seventh. Dupré prescribes articulation in *staccato* and a special registration composed only of the sound of the string registers in 16', 8' and 4' position. This combination makes the music resemble the sound of cubes in a jar and acts as a constant "shaking". The occasional chords in the *staccato* in turn evoke laughter from the soldiers. Overall, the movement gives the impression of an eerie scherzo. At bar 98 the atmosphere changes abruptly. The playing is over, there is only a simple melody which always rises on the first four notes and falls on the next four. We can think of it as the inhalations and exhalations of Christ, who has nothing left but bare skin. This simple, stripped-of-everything human simplicity is confirmed by the simplest registration on the *Flûte* 8' sound on the third manual and the final "clean" as C major.

The basic motif of the eleventh movement, *Jésus est attaché sur la Croix* (Jesus is nailed on the Cross), is the hammer blows that echo with relentless and terrible regularity. In the pedal, the motif of the cross is confirmed in the repetitive form of three descending blocks. The strikes in the manual are mostly empty chords made up of only pure fifths and pure octaves - one can look for pure and primitive human evil behind them on the one hand, and absolute pain on the other. In bar 19 the theme of pain and suffering, already familiar from the third movement, echoes into the hammer blows. This is followed by a brief lull in bar 28, as if to question whether all this suffering makes any sense at all and whether humanity is doing the right thing. In bar 29, however, the hammer blows return, shifted up a minor third - so everything is much more intense. The music of this movement is the most violent, agonising and tormenting in the whole cycle. Nor does Claudel spare the listener's imagination and feelings in his description of the crucifixion in the text. The horrible words in the context of the terrible musical commentary are brutal and literally devastating.

In the ethereal atmosphere of the twelfth stop, *Jésus meurt sur la Croix* (Jesus dies upon the Cross), the Saviour utters his last seven words. The accompanying simple harmony sounds the simple sound of the *Bourdon* 8' register, and the *Vox humana* 8' register (i.e. "human voice" - Jesus dies as a man) is used for the first and last time in the solo. The first three words (Father, forgive them; for they know not what they do / Today shalt thou be with me in paradise / Woman, behold, thy son! Behold, thy mother!) are similar in motive - they consist mostly of descending intervals and express consolation. Unusually, for the fourth word (My God, my God, why hast thou forsaken me?), Dupré uses exactly the same motif with which Jesus comforted the women in the eighth section. The invocation is symbolized by three ascending intervals - the first time by a pure fifth, the next two times by a pure fifth. At the end of the phrase the melody descends, so Jesus finds no consolation. The fifth (I thirst) and sixth words (I am finished) are built from the same motivic material. The seventh word (Father, into thy hands I commend my spirit) is sung without musical accompaniment; the motivic material of the first three words is used. Jesus is thus reconciled to his fate and dies in silence. At that moment the earth trembles, which Dupré achieved with a trill in the pedal on the notes E and F and on the sound of the deepest 32' and 16' registers. The realization of this method of musical notation causes a real acoustic tremor. There is a temple burst, which is symbolized by short two-note motifs consisting of an eighth note with a dot and a sixteenth note. Then thunders are added on dissonant chords registered on all the linguistic registers of the third manual. The scene soon quiets down, and the final bars reveal the bleakness after the accomplished Crucifixion. Only the accompaniment from the beginning of the movement sounds, but without the words of the dead Christ. It is accompanied by a deep three-note motif in the pedal. The movement ends on a deep note registered on *Soubasse* 32'. This sound seems like a glimpse into a bottomless black abyss. It has no expression, death has caused a complete end.

The thirteenth part, *Jésus est détaché de la Croix et remis à sa Mère* (The body of Jesus is taken from the Cross and laid in Mary's bosom), is a strange musical description of the unwinding and falling ropes, as well as the slowly gliding dead body they fold from the Cross. The accompaniment features a constantly repeating fast 12-note motif with minor modifications; the solo consists mostly of a four-note ascending motif. Curiously, the removal of the body is not described by Dupré in a descending but ascending melody. Is he suggesting perhaps that this body will later be resurrected and taken up to heaven? The musical picture becomes even more intense from bar 32 onwards, when the melodic motif is heard in two-part pedal and the accompaniment is doubled in the right and left hands. In bars 61-62 a *rallentando molto* comes in and Christ's body seems to rest in Mary's arms. Then the conclusion of the fourth part is quoted verbatim, where - as here - space has been given to the grieving Mother and her unspeakable pain.

The ultimate, fourteenth part, *Jésus est mis dans le sépulcre* (The body of Jesus is laid in the tomb), is a kind of epilogue to the entire cycle. It is built on the cantilena with the theme of regret that belonged to the grieving women in the eighth part. This time, however, no consolation comes. The dull musical action gradually builds up, but only using 8' labial registers, which does not allow for a very dynamic level to be reached. In bar 52 we hear this cantilena again on the *Gamba 8'* register and without harmonic accompaniment. In bar 56 a new theme is added on a strange sound composed of the *Bourdon 16'* and *Flûte 4'* registers, thus lacking the basic 8' position. This quiet theme, consisting of six quarter notes and one half note, is a quasi-explanation of the death of Jesus and serves as a mitigation of grief. In bar 69, a new musical world arrives. In the quietest possible sound of the organ - in the left hand the register *Voix célestes 8'* and in the right hand the *Flûte 4'* - both in *pianopianissimo* - it is as if the gates of heaven are opening and heavenly silence is spreading. Suffering is transformed into the fruits of the Redemption and opens the gates of heaven to all those who have participated in the recent events. As if after expressing the past horrific events, Dupré opens his soul and brings his own perspective to the story - all suffering had a higher meaning and purpose because it brings love, hope, and redemption.

4 Conclusion

Le Chemin de la Croix is not only a magnificent fusion of Claudel's poetry with Dupré's music. It offers us an unprecedented glimpse into the thought and spiritual world of both authors, while at the same time becoming a message to all of us about the meaning and value of suffering, pain, grief and the weight of "one's own cross" in our own lives. Dupré, using extremely expressive musical means, has managed to faithfully describe all the events of the biblical story of Christ's Passion, but he has also managed to enrich them with his own understanding of its meaning. The uniqueness of this monumental work also lies in the fact that it is closely linked to the poetry of Paul Claudel, without which it cannot be fully understood. Dupré has thus succeeded in creating a composition which, in its originality, scope and musical statement, occupies a unique and irreplaceable place in the organ repertoire.

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ENVIRONMENTAL EFFICIENCY OF THE EU COUNTRIES BASED ON A DEA APPROACH

^aPETER TÓTH, ^bBEÁTA GAVUROVÁ, ^cANDREA TKÁČOVÁ, ^dJANA ZAICOVÁ

Technical University of Košice, Faculty of Economics, Némcovej 32, Košice, Slovak Republic

email: ^apeter.toth@tuke.sk, ^candrea.tkacova@tuke.sk,

^djana.zaicova@student.tuke.sk

Technical University of Košice, Faculty of Mining, Ecology, Process Control and Geotechnologies, Institute of Earth Resources, Park Komenského 19, Košice, Slovak Republic

email: ^bbeata.gavurova@tuke.sk

We gratefully acknowledge the funding of this paper by VEGA No. 1/0590/22: Exploration of natural, social and economic potential of areas with environmental burdens in the Slovak Republic for the development of specific forms of domestic tourism and quantification of environmental risks.

Abstract: Measuring environmental efficiency is a key tool for monitoring the progress of EU countries in achieving common environmental policy goals. The presented study deals with this issue on a sample of 27 EU countries in the period 2000-2020 using the DEA method. The results point to persistent differences between member countries, with new member states achieving better values compared to old member states. Despite the significant reductions in greenhouse gases, sulphur oxides and nitrogen oxides that have been recorded for all EU countries, there is no improvement in environmental efficiency over time for countries with average and low efficiency, which represent eight Member States. The study also confirmed that it is possible to achieve high environmental efficiency even while achieving economic development.

Keywords: *Environmental policy, efficiency, EU countries, DEA.*

1 Introduction

The concept of sustainable development makes more sense today than ever before. Increased concerns about the global impacts of environmental pollution in countries such as China have made environmental efficiency analysis a central topic of much research. At the level of European Union (EU) countries, environmental efficiency represents the ability of Member States to produce goods and services while minimizing the negative impact on the environment. The EU actively works to promote environmental efficiency through various policies and regulations, including the EU's commitment to reduce greenhouse gas emissions, increase the use of renewable energy and promote resource efficiency (Duřová Spiřáková et al. 2020; Beltrán-Esteve & Picazo-Tadeo, 2017).

However, the EU's environmental policy faces a serious problem, which stems from significant differences in the ability of countries to apply these principles and goals at the national level, from the fear that the country will not be able to achieve sufficient economic development. An example is Poland, which, as the largest producer of hard coal in the EU, prioritizes the national interests of economic development (Marcinkiewicz & Tosun, 2015). Many EU member states changed their decision-making priorities after the economic crisis of 2008, during which their concerns about economic development were much greater (Slominski, 2016). The reason was also increasing public spending on environmental policy (Zhu et al. 2022). Thus countries promote a concept whereby environmental efficiency grows while increasing economic performance (Mardani et al. 2017). Current studies also point to a different level of environmental efficiency between the old and new member states. The results of some research concluded that old members have higher environmental efficiency (Beltrán-Esteve et al., 2019; Matsumoto et al., 2020; Sanz-Díaz et al., 2017; Zhu et al., 2022), while some studies claim the opposite, namely that new Member States have score higher in environmental efficiency (Duman & Kasman, 2018). The question remains whether states can increase their environmental efficiency at the same time as achieving economic development in the country and whether there are significant differences in environmental efficiency between new and old Member States. The answers to these research questions will be the subject of the present study.

2 Environmental efficiency in the EU countries

In recent years, many research papers on environmental efficiency have appeared, with long-term greenhouse gas emissions at the centre of interest. Some studies focus on solving the problem at the micro level (Dirik et al., 2019; Park et al., 2018), but significantly more studies focus on the macroeconomic level of countries, regions and economies (Chen et al., 2019; Iram et al., 2020; Mardani et al., 2017). At the national level, these are studies focused on environmental efficiency, primarily in China and the USA (Li et al., 2021; Chen et al., 2019), at the transnational level, they are groupings of EU or OECD countries (Halkos & Petrou, 2019; Czýzewski et al., 2020; Hermoso-Orzáez et al., 2020; Puertas et al., 2022; Zhu et al., 2022). Scholars have examined the environmental efficiency of the EU from different perspectives. For example, Sanz-Díaz et al. (2017) used the DEA and Malmquist method to measure environmental efficiency in 28 EU countries and compared the results of Spain with other EU members as a priority.

Beltrán-Esteve and Picazo-Tadeo (2017) integrated Luenberger productivity indicators, DEA, and the directional distance function (DDF) to assess the environmental performance of the EU and compared the environmental efficiency of members in different periods. They found that the environmental performance of all member states improved and there were differences in the environmental performance of older and newer members over the period under review.

Moutinho et al. (2017) evaluated the environmental performance of 26 EU countries in two steps. In the first step, the DEA method is used to measure each country's efficiency. In the second step, the quantile regression technique was used to explain the different efficiency scores through the selected variables. Duman and Kasman (2018) used parametric hyperbolic distance functions to analyse the environmental efficiency of EU member and candidate countries in the period 1990–2011. They concluded that the EU-15 countries, in contrast to the new members and candidate countries, have a greater potential for reducing CO₂ emissions while simultaneously increasing GDP and reducing energy consumption.

Hermoso-Orzáez et al. (2020) monitored a sample of 28 EU countries in the period 2005-2012 using two selected variants of the DEA method. The authors' results show that there are 14 out of 28 countries that have high relative environmental efficiency. Among the countries with very low environmental efficiency were the last acceding countries, where environmental policies were not yet implemented effectively with positive results. Puertas et al. (2022) on the analysis of 20 European countries in the period 2014-2018 confirmed that countries with low environmental efficiency are concentrated in the East of Europe. For this purpose, they used the DEA method and the Malmquist Index (MI). Zhu et al. (2022) applied the DEA method to investigate three different objectives of environmental policy in EU countries in the period 2013-2019. He confirmed that there are significant differences between states. where countries that joined the EU earlier have higher efficiency values. Czýzewski et al.'s (2020) study came up with interesting results, which examined EU countries from 2005-2016. The authors concluded that the highest efficiency of environmental spending in the context of "deadweight loss" was recorded in the countries of Central and Eastern Europe, the Scandinavian countries and Spain.

3 Methodology

The presented study's main goal is to measure EU countries' environmental efficiency. The essence of the research is the verification of the following two hypotheses, the determination of which is based on theoretical foundations:

H1: Old Member States have higher environmental efficiency compared to new Member States.
 H2: Member States with high GDP per capita achieve higher levels of environmental efficiency.

The subject of the study is 27 EU Member States in the period 2000-2020. The Data envelopment analysis (DEA) method implemented in R studio was chosen to measure efficiency, which is among the most used methods for evaluating environmental efficiency (Wei et al., 2021; Tian et al. 2020). Its use in the given area can be confirmed by several studies, see for example Moutinho et al. (2017), Park et al. (2018), Wegener and Amin (2019), Matsumoto et al. (2020) or Zhu et al. (2022) etc. DEA is a mathematical programming approach that evaluates the performance of decision-making units (DMUs). In this evaluation, the inputs that were invested in the process are compared with its achieved results (outputs) (Charles et al. 2018). In the area of environmental efficiency, the division of outputs into desirable and undesirable is added (Goto et al., 2014). In the context of environmental efficiency, DMUs can be countries, regions, organizations or firms, and inputs and outputs can be environmental indicators such as greenhouse gas emissions, water consumption, energy consumption or waste generation. DEA has been widely accepted in the scientific community due to its great flexibility in defining the problem: it accepts different measurement units for inputs and outputs and allows direct comparison of some DMUs with others as well as with their combination (Lotfi et al., 2020). Based on previous studies, the inputs and outputs were defined, which formed the basic data sample for the DEA analysis. It is recommended that the total number of inputs and outputs does not exceed 1/3 of the number of examined DMUs.

Table 1 Variables for DEA analysis

Indicator	Unit	Database	Source
Inputs			
X_1	Total public expenditure	% GDP	Eurostat
X_2	Public expenditures for environmental protection	% GDP	Eurostat
X_3	Total labour force per capita	Thousand inhabit.	OECD
X_4	Primary energy consumption	Tonnes per GDP	Eurostat
X_5	Income from environmental taxes	% GDP	Eurostat
Undesirable outputs			
X_6	Sulphur oxides (SOx)	Tonnes per GDP	Eurostat
X_7	Greenhouse gases (CO ₂) per capita	Tonnes per HDP	Eurostat
X_8	Nitrogen oxides (NO ₂)	Tonnes per HDP	Eurostat
Desirable outputs			
X_9	GDP per capita	EUR	Eurostat

Source: own processing.

Input variables X_3 to X_8 were subsequently adjusted and expressed as a ratio indicator concerning GDP per capita in constant prices or as a % of GDP in the case of environmental taxes. The robustness of the DEA model is affected by the degree of correlation between the variables. Before creating the correlation matrix, a normality test is performed using the Jarque-Bera and D'Agostino tests. A value of 0.8 is a high degree of correlation and testing takes place at a significance level of 0.01; 0.05; 0.1. Based on the study by Hermoso-Orzáez (2020), an evaluation scale of environmental efficiency was compiled for the median values of EU countries as "• excellent environmental efficiency" (0.99-1), "• good environmental efficiency" (0.8-0.99), "• average environmental efficiency" (0.5-0.79), "• low environmental efficiency" (0-0.49).

We applied a model based on Seiford and Zhu (2002). Let DMU_j denotes n independent decision units ($j = 1, 2, \dots, n$), each DMU_j needs m inputs x_{ij} , ($i = 1, 2, \dots, m$) to produce s_j desirable

outputs y_{rj}^g ($\bar{r} = 1, 2, \dots, s_j$) and s_2 undesirable outputs $\bar{y}_{\bar{r}j}^b$, ($\bar{r} = 1, 2, \dots, s_2$). Model is given by the following expressions:

$$\begin{aligned}
 & \text{Max } \beta_p \\
 & \sum_{j=1}^n \lambda_j x_{ij} \leq x_{ip}, \quad i = 1, 2, \dots, m; \\
 & \sum_{j=1}^n \lambda_j y_{rj}^g \geq \beta_p y_{rj}^g, \quad \bar{r} = 1, 2, \dots, s_1, \\
 & \sum_{j=1}^n \lambda_j \bar{y}_{\bar{r}j}^b \geq \beta_p \bar{y}_{\bar{r}j}^b, \quad \bar{r} = 1, 2, \dots, s_2, \\
 & \sum_{j=1}^n \lambda_j = 1, \lambda_j \geq 0, \quad j = 1, 2, \dots, n \\
 & \text{where } \bar{y}_{\bar{r}j}^b = -\bar{y}_{\bar{r}j}^b + w_{\bar{r}} > 0
 \end{aligned} \tag{1}$$

3 Results

Based on the results of the Jarque-Bera and D'Agostino tests in our R study, the hypothesis of the normality of the set was rejected, leading to the use of non-parametric correlation tests such as Kendall's and Spearman's correlation coefficient, which are robust to outliers and do not assume data normality. The results of the correlation matrix are presented in Table 2.

Table 2 Correlation matrix

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
X_1	1	-0.02	-0.07	-0.35	0.23	-0.44	-0.45	-0.38	0.41
X_2	-0.01	1	-0.27	-0.10	-0.03	-0.02	0.08*	-0.08	0
X_3	-0.04	-0.19	1	-0.23	-0.02	-0.32	-0.25	-0.25	0.35
X_4	-0.25	-0.06	-0.16	1	0	0.82	0.78	0.74	-0.87
X_5	0.15	-0.03	-0.02	0	1	-0.01	0.07	0.13	0.016
X_6	-0.23	-0.01	-0.22	0.64	-0.006	1	0.86	0.82	-0.79
X_7	-0.32	0.06*	-0.17	0.61	0.05	0.67	1	0.74	-0.75
X_8	-0.26	-0.06	-0.17	0.58	0.09	0.66	0.57	1	-0.74
X_9	0.29	0.01	0.25	-0.68	0.02	-0.61	-0.56	-0.57	1

Source: own processing.

Based on the correlation matrix, variables X_1 and X_4 were selected as inputs to the model. Variables X_2 and X_3 and X_5 were discarded due to low values of correlation coefficients with the considered outputs. Indicators X_7 , X_8 and X_9 were selected as outputs for the DEA model. Indicator X_6 was excluded due to the high correlation coefficient with indicators X_7 and X_8 . By excluding the variables, the conditions for DEA analysis, which requires a low correlation between selected inputs and a high correlation between inputs and outputs, were met.

In the case of variables X_7 and X_8 , a deeper analysis and comparison of countries over time was carried out, which is illustrated in Figure 1 and Figure 2.

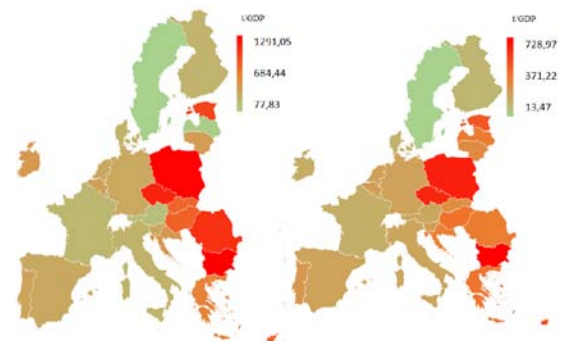


Figure 1 Greenhouse gases (CO₂) of EU countries (tonnes of GDP) - comparison of 2000 (right map) and 2020 (left map)
 Source: own calculation.

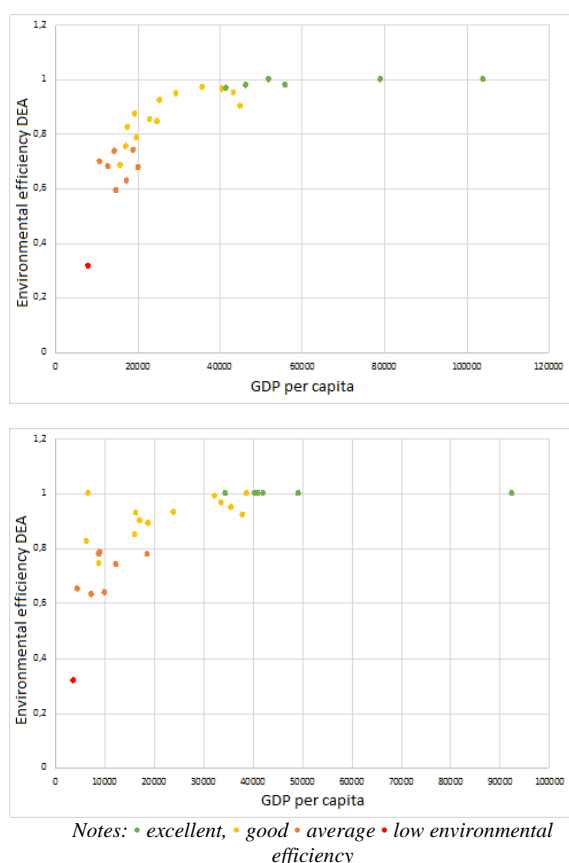


Figure 3 GDP per capita and environmental efficiency according to the DEA method for 2000 (up) and 2020 (down)
Source: own processing.

Figure 3 points out that the EU Member States that achieved a high level of environmental efficiency in the monitored periods are among the states with the highest GDP per capita. Conversely, states with low environmental efficiency are at the bottom of the GDP per capita ranking. A simple illustration of the results thus confirms H2: States with high GDP per capita achieve a higher level of environmental efficiency, which is in line with Duman and Kasman (2018). The results need to be seen in a wider context. The old Member States have been working for a long time to achieve the EU's environmental goals by increasing the use of renewable resources, a high rate of recycling or transitioning to a circular economy.

4 Discussion and conclusion

The concept of sustainable development makes more sense today than ever before. Increased concerns about environmental pollution problems in countries such as China have made eco-efficiency analysis a central issue of much research. The countries of the European Union have also set strategic goals that support a sustainable environmental framework.

The presented study aimed to measure the environmental efficiency of EU countries using the DEA method, which is often used in this issue. With the help of the R program, efficiency was measured in each of the years 2000-2020, and then the median from the periods 2005-2012, 2013-2020 and 2000-2020 was calculated. The results showed a significant difference in environmental efficiency across EU countries, with the old Member States performing better than the new Member States, thus confirming H1. Countries such as Latvia, Lithuania, Slovakia, and Slovenia come closest to the old Member States. Countries such as Poland, Czechia, Romania, and Bulgaria lag significantly behind. The results largely agree with other studies in this area even when using different inputs and outputs in DEA analysis.

Comparing the results of DEA and GDP per capita also led to the acceptance of H2: States with high GDP per capita achieve a higher level of environmental efficiency. The finding that countries with higher GDP per capita produce fewer emissions that significantly affect environmental efficiency is a consequence of the introduction of more effective environmental policies that support technological progress, improved energy efficiency and the use of cleaner energy sources. Examples include countries such as Sweden, Luxembourg, and Ireland, which are actively taking steps to reduce greenhouse gas emissions and achieve their climate goals. They introduced instruments such as the climate law, the carbon tax, financial support for renewable energy sources and free public transport by buses, trams, and trains or the "polluter pays" rule. Overall, these countries are making significant efforts to transition to a low-carbon economy and reduce their environmental impact, using environmental policy principles and a combination of normative and economic instruments. The results of the DEA analysis confirmed the low position of Bulgaria, which covers 20% of the total energy consumption with renewable sources. However, it still lags behind the standards set in the directive on municipal wastewater treatment and air pollution. The conviction that economic growth should take precedence over changes in environmental protection has persisted in Poland for a long time. The results of the study proved that this is a false assumption. Fossil fuels accounted for 70% of Poland's energy sources in 2020, and coal is expected to remain the country's main energy source until 2049. Problems are also emerging in waste management. For countries such as Estonia, Hungary, Poland and the Czech Republic, the EU's goals of environmental neutrality in 2050 seemed too ambitious, leading to the blocking of the "Green Deal".

The presented study confirmed that significant differences between EU Member States persist for a long time. Despite the demonstrable fact that countries with high environmental efficiency can produce high economic growth, many countries are reluctant to gradually reorient at least part of their industry to sectors with smaller negative impacts on the environment. If countries were to adopt this change, its effect would only be demonstrated after a few years, and it would have to gain high and consistent political support. The main problem uncovered by this study is the fact that, even though all EU Member States are making significant progress in achieving environmental goals when measuring efficiency, the groups with average and low efficiency are still the same countries. Without major national reforms and commitment from the EU, for example in the form of a different system of allocation of funds for this area, it will not be possible to achieve a reduction of the gap that exists between EU Member States in this area even in the horizon of a decade.

For a more in-depth examination of the issue, it would be appropriate to supplement the monitored variables in the DEA analysis with, for example, technological progress, or to monitor the dynamics of changes in environmental efficiency. Likewise, to examine the existence of the influence of the type of environmental expenses on efficiency. It seems interesting to examine the geographical interconnectedness of countries given the worse results of the eastern countries of the EU and the impact of non-member states on the environmental efficiency of neighbouring EU Member States.

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Primary Paper Section: A

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ANTI-CRISIS POTENTIAL OF THE SYSTEMS OF FINANCIAL REGULATION AND CONTROL OF TRANSPORT SERVICES IN UKRAINE

^aOLEKSANDR TREGUBOV, ^bANATOLII HORBAN,
^cVALERIIA KOLOSOK, ^dOLENA KHADZHYNova,
^eEDUARD KOLOSOK, ^fSVITLANA RUSANOVA

^a*Vasyl' Stus Donetsk National University, 21, 600-richchia str., 21021, Vinnytsia, Ukraine*

^b*State University of Infrastructure and Technologies 9, Kyrylivska str., 04071, Kyiv, Ukraine*

^{c,d,e}*Pryazovskyi State Technical University, Mariupol-Dnipro, 29, Gogol str., 49005, Dnipro, Ukraine*

^f*Odesa National Maritime University, 34, Mechnikova str., 65029, Odesa, Ukraine*

email: ^aa.trigubov@donnu.edu.ua, ^binnakdvt@ukr.net, ^ckolosok_v_m@pstu.edu, ^dkhadzhyanova_o_v@pstu.edu, ^ekolosok_ed_v@pstu.edu, ^frusanova20140909@gmail.com

Abstract: The article considers modern-specific features of the formation of the strategy of anti-crisis management of the transport complex of Ukraine in modern conditions. The need to strengthen financial control over the activities of transport enterprises is identified. The dynamics of freight and passenger traffic in Ukraine in recent years have been analyzed and the reasons for the transformation of their structure have been studied. The conceptual foundations for the formation of a strategy for the anti-crisis financial management of the transport industry are determined, which will generally improve the profitability and profitability of enterprises in this sphere. The necessity of wide involvement of shareholders of transport enterprises in the implementation of financial control functions to improve the efficiency of their functioning has been proved.

Keywords: financial regulation, financial control, financial management, transport services, transportation.

1 Introduction

In the current conditions of destabilization of Ukraine's economic system due to the destructive impact of Russian aggression, there is an imbalance in the financial system and a general decline in the competitiveness of the national economy, which directly depends on the effectiveness of state financial regulation and control of various areas of economic activity. One of the most important sectors affected by state financial regulation and control is the transport sector. Ukraine is no exception to the global pattern in this regard, so financial regulation of transport services is important for ensuring the growth of its economic development and competitiveness. However, the transport industry has long faced financing and control problems, which could lead to a crisis situation in the industry. This necessitates an objective study of the anti-crisis potential of the systems of financial regulation and control of transport services in Ukraine.

The solution to these problems should be based on an in-depth analysis of the current system of financial regulation and control in the transport sector of Ukraine, as well as on identifying opportunities for its improvement in the current crisis situation. This requires a thorough study of such issues as the role of financial regulation and control in the transport sector, an analysis of the current system of regulation and control in the transport sector of Ukraine, and a focus on identifying opportunities to improve the anti-crisis potential of the entire system. At the same time, the need to study the anti-crisis potential of the systems of financial regulation and control of transport services in Ukraine is aimed at considering the possibilities of ensuring effective financial regulation and control in the transport sector. It is important to note that crisis situations can arise not only due to economic factors but also due to natural disasters, man-made accidents, the impact of military operations, and other events. Such situations can have a significant impact on the financial condition of the transport industry and, consequently, on the state of the entire national economy.

The solution to these problems is also linked to the need to analyze the effectiveness of the current system of financial regulation and control of transport services in Ukraine.

Particular attention should be paid to the role of state institutions involved in financial regulation and control in the transport sector. Such an increase in efficiency may result in the development and implementation of an appropriate state regulatory policy for the transport industry in Ukraine, as well as the transformation of business processes related to the development of transport infrastructure and the improvement of the quality of transport services. All of this makes it important to study the principles of effective financial regulation and control, which will help to formulate the principles of sustainable development of the transport industry in crisis situations, which is extremely important for the further development of the national economy.

2 Literature Review

Research on the formation of the anti-crisis potential of financial regulation and control systems in the field of transport services has become particularly relevant in the last few years due to the growing challenges associated with changing economic conditions, the effects of global crises, industry reforms, and the emergence of new technical and technological innovations in this area. All these factors create a number of complications in the work of transport companies and cause significant changes in the transport services market. From the perspective of the need to ensure the efficiency of Ukraine's transport industry, it is particularly interesting to study the potential of financial regulation and control of transport services.

In particular, a significant amount of scientific work in this area has been carried out by various researchers to identify effective methods of financial regulation and control of transport services. In this aspect, it is necessary to note the study of V. V. Shklyar, who points out that in order to ensure effective control and stimulate the development of transport enterprises, it is necessary to take into account both financial performance indicators and economic efficiency indicators. And for effective prevention and overcoming of crisis phenomena, transport enterprises need to have a developed and tested list of anti-crisis measures that will eliminate crisis manifestations at the first signs of instability [26].

An important contribution to the study of the principles of crisis management of the transport industry was made in the works of I. K. Pishenin, who substantiated the need to form and implement an anti-crisis strategy for the development of the transport complex of Ukraine in accordance with the current trends in the development of the national economy of the state, found out the trends in the development of the Ukrainian transport complex, determined the need for an in-depth analysis of the financial and economic activities of transport enterprises, and also considered alternative ways to overcome the crisis [25].

The resource aspects of forming the effectiveness of financial regulation and control in the real sector, considered in the study by R. I. Oleksenko, are also important for the formation of the anti-crisis potential of the transport industry in the context of the need for its modernization. In particular, the author argues that the strategic direction of modernization of the sectoral structure of the national economy brings to the fore the problem of mobilizing the necessary resources, including through the curtailment of structurally depressed industries. In the process of their liquidation or partial curtailment, resources, space, and labor force are freed up, which can then be redistributed to priority industries [23].

The need to formulate a strategy for the development of the transport industry in Ukraine focused on the widespread use of financial instruments for risk management in the industry, is widely covered in the study by O. M. Vovk, who argues that

currently, strategies for international trade in transport services are not given adequate attention by the foreign economic agency. Transport services of a foreign trade nature have become the responsibility of transport ministries and have ceased to be an integral part of the state's foreign economic strategy [39].

In addition, it is worth noting the significant developments that reveal the problems of financial regulation and control in the transport sector, which are set out in the works of such researchers as I. Britchenko [1-9], M. Dziamulych [10-18], N. Hurzhyi [19], A. Hrebennikova [20], M. Khutorna [21], O. Laburtseva [22], I. Parasi-Verhunencko [24], T. Shmatkovska [27-31], R. Sodoma [32-34], I. Tofan [36], I. Tsymbaliuk [37], O. Vovchak [38], V. Yakubiv [40], I. Yanenkova [41], O. Yatsukh [42], and many others.

In general, taking into account the existing scientific developments in the field of formation of the anti-crisis potential of financial regulation of transport services, it can be concluded that the existing problems associated with insufficiently effective financial regulation and control of the transport sector in the current crisis remain relevant and need to be addressed and ways to solve them.

3 Materials and Methods

The research materials included statistical data and documents related to financial regulation and control of transport services in Ukraine. Statistical data were obtained from official sources, such as the State Statistics Service of Ukraine and the Ministry of Infrastructure of Ukraine. Documents were collected from the websites of the relevant government agencies, as well as from research and publications on the subject.

The following methods were used to analyze the research materials: analytical review, comparative analysis, and statistical data processing. The analytical review consisted of collecting and systematizing data related to the financial regulation and control of transport services in Ukraine. The comparative analysis allowed comparing statistical data for the analyzed period and identifying trends in the system of financial regulation and control of transport services.

Excel software and the R statistical package were used for statistical data processing, in which several elements of statistical analysis were carried out. In the process of assessing the potential of the system of financial regulation and control of transport services, methods of analysis and comparison were used, in particular: analysis of the legislative framework, and analysis of financial statements of transport enterprises. The analysis took into account the indicators of financial flows and financial flows in the transport sector of Ukraine in general.

4 Results and Discussion

In the current conditions of transition and adaptation to the new conditions of the information and digital economy, the functioning of business processes in the field of transport services is increasingly accompanied by a tendency to increase the number of enterprises in crisis. One of the main reasons for these trends is the general imperfection of crisis management and the lack of evidence-based recommendations for its development, especially in the area of financial regulation and control. As a result, enterprises lose the ability to maintain their production facilities and resource potential and are unable to prevent the loss of capital and solvency, which ultimately creates the preconditions for their bankruptcy. At the same time, crisis management does not allow for a clear identification of the anti-crisis measures that form its basis. This complicates the decision-making process, as there is no time to develop and test anti-crisis measures in a crisis. Therefore, in order to effectively prevent and overcome crises, transport companies need to have a developed and tested list of anti-crisis measures that will eliminate crisis manifestations at the first sign of instability. At the same time, the general

regulation of the transport sector, which requires improvement of the system of control over the movement of financial flows, significantly complicates such anti-crisis activities, as it requires coordinated actions at both the industry level and the level of its enterprises.

In recent years, there have been growing problems with the efficiency of the transport sector in the international market of transport services, where there is an objective threat of Ukraine losing a certain market share and turning from a leading exporter to an importer of these services. At the same time, Ukraine is still at the stage of formation and consolidation of the transport industry, being inferior to Western European countries in terms of both the quality and complexity of services provided by national transport companies. According to experts, the further development of the Ukrainian transport services market and changes in competitive conditions in the market will directly depend on external and internal factors [39].

At the same time, transport occupies a special place in the country's economic system, as it provides a link between different sectors of the economy. In addition, it is through the transport complex that products move from the sphere of production to the sphere of circulation, and therefore transport activity is a continuation of the production process within the circulation. At the same time, one of the characteristic features of the crisis in the transport sector is the sharp changes in the external environment of the organization. All this requires the formation of a strategy for overcoming crisis measures in the transport sector since an effective strategy allows timely adaptation to changes in business conditions. At the same time, the formation of an anti-crisis strategy for the transport sector is preceded by a strategic analysis of the transport services market and consumer capabilities of users, which allows to study of the factors of the external and internal environment of the transport sector and draw appropriate conclusions about the future direction of activity.

Table 1: Volume of freight transportation by type of carrier in Ukraine in 2017-2021, mln. tones

	2017	2018	2019	2020	2021
Railway	339.6	322.3	312.9	305.5	314.3
Sea	2.3	1.9	2.1	1.8	1.7
River	3.6	3.7	4.0	3.8	3.6
Motor vehicles	1,121.7	1,205.5	1,147.1	1,232.4	1,441.9
Air	0.08	0.10	0.09	0.09	0.08
Pipeline	114.8	109.4	112.7	97.5	77.6

Source: [35].

As Table 1 shows, the analyzed period saw a reduction in freight traffic by all modes of transport, except for road transport. This indicates a reorientation of the transport sector towards servicing business processes through the most mobile transport sector. In addition, this growth in road freight is driven by the rapid growth of small and medium-sized businesses and the significant expansion of the service sector in Ukraine over the period. As these areas of economic activity are mainly served by road transport, this growth has led to an increase in the share of road freight. At the same time, the significant decline in pipeline transportation was largely due to political reasons in connection with Russia's aggressive policy.

Significant changes also occurred in the field of freight transportation after the outbreak of the war with the Russian invaders, when in 2022, freight turnover decreased by 42.7% compared to the previous year to 165.935.7 million tonne-kilometres. Similar trends were observed in the passenger transport sector, with total passenger turnover down 50.4% to 31,142.8 million passenger kilometres [ukrstat]. At the same time, this had a significant critical impact on the passenger transport industry, as it had already suffered significantly in previous years under the influence of the corona crisis (Table 2).

Table 2: Number of passengers transported by type of carrier in Ukraine in 2017-2021, mln. passengers

	2017	2018	2019	2020	2021
Railway	164.9	157.9	154.8	68.3	119
Sea	0.03	0.07	0.08	0.05	0.07
River	0.56	0.6	0.59	0.26	0.39
Automobile (buses)	2,019.3	1,906.9	1,804.9	1,083.9	1,089.3
Air	10.6	12.5	13.7	4.8	9.3
Trams	675.8	666.2	627.5	422.8	398
Trolleybuses	1,058.1	1,016.2	945.7	579	594.4
Subways	718.9	726.6	715	411.2	482.6

Source: [35].

As we can see, the crisis trends in passenger transport are manifested in the unstable dynamics of traffic volumes by all modes of transport, which generates risks of financial instability for both transport companies and the entire industry. In addition, if we talk about road freight transport as a sector that demonstrates a steady increase in terms of traffic volumes, it is worth assessing the structure of cargo by type in order to evaluate which industries and business processes are most dependent on this type of transport and which of them generate the largest share of the industry's profits (Fig. 1).

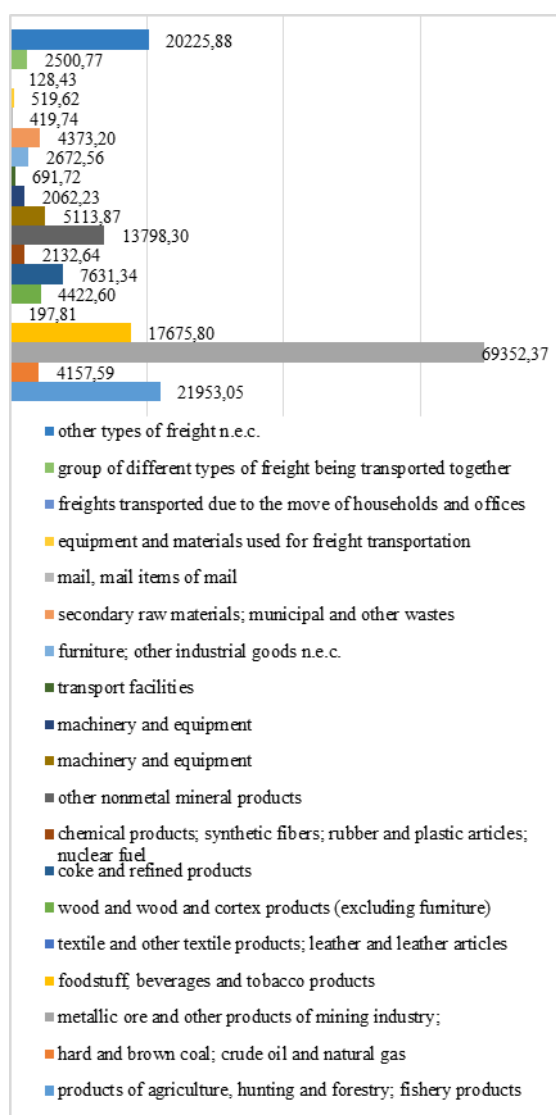


Figure 1 – Structure of freight transportation by motor transport by freight nomenclature 1 in 2021
Source: [35].

As we can see, metal ores and mining products accounted for the bulk of road freight traffic in Ukraine in 2021. In recent years, there has been a significant reorientation of such traffic from rail to road transport. The second largest volume of traffic was the transport of agricultural products, driven by the intensive development of this sector in Ukraine after large agricultural holdings entered the EU markets in 2017. Such changes also require the transformation of the transport industry in the context of the need to upgrade the fleet of vehicles to specialized ones designed for heavy-duty transport. This, in turn, requires sufficient financial resources for such investments by transport companies. To a large extent, these needs are covered by bank lending, the success of which depends on the financial stability of these companies.

In general, we conclude that there is an objective need to formulate a strategy of anti-crisis management of the system of financial regulation and control in the transport sector of Ukraine to ensure the efficiency of its functioning and solve existing problems in the field of passenger transportation.

Different approaches are currently used to formulate an anti-crisis strategy for the development of the transport sector. The most effective anti-crisis measure is the formation of a strategic set of a transport enterprise, i.e. specific strategies at each level of the strategic hierarchy. This approach covers all types of activities and areas of development of a transport organization, including the tools of financial regulation of the industry. Accordingly, the objectives of the anti-crisis strategy of the transport sector should be

– ensuring liquidity and solvency of the transport industry based on the optimal combination of own and borrowed sources of funds by enterprises;

– generating profits and ensuring an appropriate level of profitability sufficient to meet all the needs of the transport sector in the course of the main, investment and financial activities of the transport complex.

The success of crisis management in the transport sector often depends on the availability of financial resources required for anti-crisis actions. Measures to increase cash flows in such cases can only be effective if a control system is established that provides for daily reconciliation of the balance sheet for the duration of the anti-crisis programs, weekly or even daily approval of expenditures, and transfer of the right to allocate funds to the top managers of the transport companies themselves. At the same time, when the threat of a crisis is determined by the negative general economic situation in the country, which is currently observed in Ukraine as a result of military operations, it is necessary to change some aspects of relations with banking institutions that are responsible for providing credit resources to enterprises.

The basic component of the anti-crisis strategy for financial regulation and management of the transport sector is the development of a comprehensive package of powers to perform the function of crisis management at the level of corporate governance of enterprises. At the same time, the main condition for implementing such a strategy is compliance with the laws and rules of corporate relations, which ensures that the interests of transport business participants are respected. Another important aspect is the need to harmonize the governance system of Ukrainian transport companies with global corporate governance standards. Finally, it is also necessary to take into account the specific role of corporate governance bodies in the transport sector in performing the function of crisis management. This role can be informational, advisory, participatory, or controlling, depending on the ultimate goals underlying the strategy.

Thus, based on the above, it is possible to formulate the conceptual provisions of the anti-crisis strategy of financial regulation and control of transport services, which include the following stages:

- development of an effective system of control over the financial activities of transport enterprises in order to prevent financial irregularities and excessive declared expenses;
- establishing transparent and clear rules for setting tariffs for transport services that take into account all components of the companies' costs and ensure their profitability;
- development of an effective state system for monitoring and analyzing the transport services market in order to prevent possible crises and take timely measures to avoid them;
- improving the system of liability insurance of enterprises for damage caused to passengers or their property, which will help ensure high quality and safety of transport services;
- attracting investments for the development of transport infrastructure and increasing the level of technical equipment of transport enterprises, which will help to improve their competitiveness and the quality of services;
- conducting systematic work to reduce corruption and abuse of power in the transport services sector, which will help to increase confidence in transport companies.

The details of these provisions of crisis management in the transport sector should be tailored to the specific needs of the transport industry in terms of anti-crisis activities. At the same time, shareholders and managers of transport companies should be guided by the organizational design of crisis management subsystems and the need to delegate financial control functions to each corporate governance body. At the same time, the stage of development of crisis phenomena in the transport industry as a whole should be taken into account.

5 Conclusion

Thus, we conclude that the process of developing an anti-crisis strategy for financial regulation and control of the transport sector is associated with the need to solve the problems of achieving results as soon as possible, which are manifested in the growth of the level of profitability of transport enterprises, in the conditions of the internal environment and the market situation. The formation of an anti-crisis strategy for the transport sector should also be preceded by a strategic analysis of the industry's financial flows, which allows one to study the external and internal environment of transport companies and draw appropriate conclusions on the future direction of stabilization and control of their financial activities.

The state also plays an important role in the process of anti-crisis financial management, with the main goal of ensuring effective macroeconomic regulation based on support for the national transport industry. In general, the need to improve the mechanisms of internal financial control at transport enterprises is of particular importance, which is possible only if shareholders are more actively involved in the implementation of corporate control in the management system of the transport sector of Ukraine.

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RELATIONSHIP BETWEEN STRATEGIC THINKING AND DIMENSIONS OF PERSONALITY

^aDAVID ULLRICH, ^bJIŘÍ KOLENÁK, ^{c,d}KARINA TATEK BENETTI, ^eVRATISLAV POKORNÝ

^{a,b,c,e} NEWTON University 5. května 1640/65, Nusle, 140 00 Praha 4, Czech Republic

^d Technical University of Liberec, Studentska 1402/2, 461 17, Liberec, Czech Republic

email: ^adavid.ullrich@newton.university;

^bjiri.kolenak@newton.university;

^ckarina.benetti@newton.university; ^ekarina.benetti@tul.cz;

^dvratislav.pokorny@newton.university

Abstract: The article aims to provide data to address the gap in the potential relationships between the level of strategic thinking and dimensions of personality. In today's turbulent and complex environment, it is important for managers who are in leadership positions to have specific personality traits and a higher level of strategic thinking. This study aims to identify (i) potential relationships between the level of strategic thinking and individual dimensions of personality, and (ii) the strength of these relationships. The basic interpretive study was conducted with managers across all security branches (military, security, police). The participants were tested and results were reviewed and discussed. The testing development process was also explored in depth. Findings were verified via member checks and triangulation. The three tested groups of managers showed a higher level of strategic thinking.

Keywords: leadership; strategic thinking; personality types; dependency analysis; correlation

1 Introduction

In today's rapidly changing global environment (Chatterjee, 2014), the importance of competent leadership is highlighted. It is the leadership, as suggested in scientific studies (Bolwijn, Kumpe, 1990; Waldman, Bass, 1991; Stoker et al., 2001) that facilitates innovation. However, although the extant leadership literature has focused on various outcomes, such as satisfaction, efficiency, and performance, it has not addressed the impact of leadership on innovation (Bass, 1990; Howell, Higgins, 1990; Jelaca et al., 2020). De Weerd-Nederhof (1998) concluded that direct control is a common result of teams, but leadership and the impact of individual personality characteristics of team members, especially the team leader on the innovation process, is not clear (Stoker et al., 2001). Chatterjee (2014) attempted to fill this literature gap by creating a dimension of the leadership capabilities of innovators and defenders' organizations. It is important to identify the basic personality dimensions and how personality factors predict behaviour in the work environment. Additionally, the leadership literature has always placed more emphasis on the behavioural characteristics of leaders, since the importance of "personality" as an individual variable of leaders cannot be ignored (Stříbrný et al., 2022; Smiljanic, 2016).

Since the 1980s, there have been studies on the relationship between Myers-Briggs Type Indicator (MBTI) and NEO Personality Inventory-Revised (NEO-PI-R) results. Myers and McCaulley (1985) found that the extraversion, intuition, feeling, and judging scales of the MBTI correspond to the E (the general tendency to be outgoing), O (the general tendency to be curious about both inner and outer worlds), A (the general tendency to be altruistic), and C (the general tendency to be able to resist impulses and temptations) of the NEO-PI-R model, respectively. Several studies examined the relationship between the MBTI and NEO-PI-R Five Factor model of personality (Myers, McCaulley, 1985; McCrae, Costa, 1989, 1991a, 1991b; Furnham, 1996). Furnham, Moutafi, & Crump (2003) argued that the four MBTI indices measure aspects of four of the Five Factor Model dimensions.

A substantial literature survey shows that several studies have examined the relationship between leaders' personality styles and other managerial competencies. However, no previous study has examined the connection between a higher degree of strategic thinking, which every leader should have, and the individual dimensions of personality (May-Chiun et al., 2015).

With the development of personality type testing for managerial positions, scientific research has focused on analysing the relationships between personality types and other managerial competencies. For example, Sieff & Carstens (2006) investigated the relationship between personality type and leadership, Bajcar, Babiak, & Nosal (2015) studied the relationship between leadership style and the level of strategic thinking. Ambrozová et al. (2016) explored modern trends in management, using knowledge of cognitive and behavioural sciences (results of research on the relationship between stress and mental condition, and the level of critical thinking, problem-solving, and decision making). Ullrich et al. (2019) identified the personality potential and sources of professional managers that are crucial for the effective management of challenging situations, and Newcomer & Connelly (2020) investigated personality type by MBTI and leadership and their potential impact on their level of strategic thinking.

Thus, there is an elaborate theory of personality typology according to the MBTI framework (Myers, McCaulley, 1985) and the levels of strategic thinking for individual personality types. However, it is preferable to understand them as only indicators.

Gallén (1997) investigated the cognitive style and strategic decisions of managers and top management teams building on many studies (e.g. Henderson, Nutt, 1980; Haley, Stumpf, 1989; Haley, Pini, 1994), then completed his work in his dissertation (Gallén, 2010) producing interesting results. The MBTI is used to classify managers' behaviour, particularly, their cognitive style. The strategy was analysed using Miles & Snow's (1978) organizational typology. The main research question was: does the cognitive style influence the strategic decisions of managers and the preferences of top management teams? He summarized the results of his four published articles in the dissertation. The most important conclusions of his research are as follows:

- He presented a theoretical model in which he summarized the proposed relationships between the cognitive styles and strategy types;
- he emphasized that managers' self-understanding is very important and that the differences in strategic decisions cannot be attributed to different information but different interpretations based on the managers' cognitive styles;
- the way of perception has an effect on the strategic decisions of managers;
- cognitive composition has an effect on the preferences of top management teams with respect to strategies.

Nevertheless, the extant literature lacks a comprehensive analysis of the relationship between personality types according to various standardized questionnaires and the level of strategic thinking. Therefore, this study is essential for researchers and academics because it addresses two main gaps in the literature. First, it provides data to address the gap in the complex system literature by making comparisons and investigating potential relationships between the degree of strategic thinking (measured using a basic test) and the dimensions of personality (evaluated by selected modern personality tests).

Second, because the research group comprises a very specific group of managers with a certain level of education, a specific type of profession, managerial experience, and work experience, a certain level of strategic thinking can be assumed. The study investigates how strategic thinking, measured using the Strategic Thinking Self-Assessment from Harvard University (2005), is affected by personality types, measured using modern personality types and other selected tests. These selected modern personality tests include The Short Dark Triad Test (SD3), the NEO-Five Factor Inventory (NEO-FFI), the System of Basal Psychological Self-Regulation of Personality (SPARO test), and the Golden Profiler of Personality (GPOP test). Furthermore. Additionally, the Coping Strategies Questionnaire (SVF-78) was

used, which describes the strategies that an individual uses to manage stressful situations. Totally, 121 variables were developed and tested in this study.

1 Theoretical Background and Hypotheses Development

Mintzberg (1994) defined strategic thinking as based on the need for recognition of new possibilities and the ability to put pieces together to see the big picture.

Experts have been dealing with the issue of strategic thinking and its absence among senior managers since the 1990s (Mason, 1986; Zabriskie, Huellmantel, 1991; Mintzberg, Ahlstrand, Lampel, 1998; Liedtka, 1998a, 1998b; Bonn, 2001, 2005; Essery, 2002; Tovstiga, 2010). According to Hambrick (1989), as the basis of competencies, identifying the strategic characteristics of a leader is as essential for understanding competencies as why and how organizations behave and perform. Despite all the research so far, it can be stated that developing tools for the identification of strategic thinking competencies remains somewhat elusive (Steptoe-Warren, Howat, Hume, 2011).

The current research in the field of strategic thinking focuses on the study of relationships between strategic thinking dimensions and entrepreneurship (Ghorbani, Fattahi, 2013), analysing the impact of strategic thinking competencies on building intelligent organization (Al-Zu'bi, Al-Nawasrah, 2017), and developing scales to measure strategic thinking (Dhir, Dhir, Samanta, 2018).

The closest research to the examined issue in this study is that of Nuntamanop, Kauranen, & Igel (2013) who created a new model of strategic thinking competency. They included the following competencies in their model: conceptual thinking, visionary thinking, creativity, analytical thinking, learning, synthesizing, and objectivity. However, this new model of strategic thinking competency lacks a very important competence, that is, critical thinking, which is addressed by our study. Further research was conducted by Goldman and Scott (2016) to investigate the competency models used by organizations to assess the strategic thinking ability of their leaders, managers, and other employees. Dragoni et al. (2014) focused their research on developing leaders' strategic thinking through global work experience. Moreover, the structure and process of strategic thinking have been explored by Amitabh and Sahay (2012).

Newcomer & Connelly (2020) investigated the potential impacts of officers' personality types and characteristics on their ability to lead in the military. This research resembles ours but differs in that it used the results of the MBTI test, a four-digit preferred type of personalities. Nevertheless, the authors themselves saw the limitations of their research, as this tool does not measure the size of each preference but assigns a preference type according to the test results. Our research removes this limit, as it does not work with the results of the MBTI test, that is, a four-digit preference type, but with single preferences.

Personality tests can be divided according to various aspects. One of the possible divisions is into projective methods, questionnaires and inventories, objective personality tests, and assessment scales. We focus mainly on questionnaires and inventories, and especially on multidimensional ones that map and cover more dimensions of personality. These questionnaires include SD3 (Jones, Paulhus, 2013), NEO-FFI (McCrae, Costa, 1989), SPARO original Czech questionnaire (Mikšík, 2004), and GPOP (Golden 2005). Additionally, we used the SVF-78 questionnaire, which describes the strategies used by an individual to cope with stressful situations (Janke, Erdman, 2002).

2 Aim, Methodology and Data

First, the article aims to provide data to address the gap in the complex system literature by making comparisons and investigating potential relationships between the level of

strategic thinking (measured by a basic test) and personality traits (evaluated using selected modern personality tests).

Second, we analyse the dependence of the degree of strategic thinking (measured by the Strategic Thinking Self-Assessment from Harvard University) on personality types (evaluated using selected modern personality type tests: SD3, NEO-FFI, SPARO, and GPOP). Furthermore, the SVF-78 questionnaire is used to describe the strategies that an individual uses to cope with stressful situations. For analysis, the examined values (i.e. the results of individual tests) were recalculated using the same scale (in our case, a scale from 0 to 10) so that the Pearson correlation coefficient could be used for the correlation analysis.

The research has been carried out since 2019. The study shows the results of test analyses for 2019. The tests had a 100% return. The total number of managers in 2019 was 16, 25, and 10 in Prague, Brno, and Bratislava, respectively. The total number of accepted tests was 51, which represents 100% of the respondents. The Strategic Thinking Self-Assessment (Harvard, 2005), comprises 25 basic questions with the answers evaluated on a scale from 1 to 5 (1 = rarely, 5 = usually). According to the number of achieved points, the level of strategic thinking is evaluated as follows:

- 104–125 (Exceptional): You are a talented strategic thinker who possesses many of the traits, behaviours, attitudes, and cognitive capacities that are necessary for thinking strategically.
- 78–103 (Superior): You are a highly effective strategic thinker in many areas, but would benefit from refining some of your skills.
- 51–77 (Adequate): You know and practice many of the basics of strategic thinking. However, you can increase your success by further expanding your skills.
- 25–50 (Deficient): You will need to work broadly on your strategic thinking skills so that you can learn how to analyse opportunities and problems from a broad perspective and understand an action's potential impact on others.

The Short Dark Triad Personality Test (SD3) is a brief personality test that was developed by Jones & Paulhus (2013). Apart from the many normal personality traits, some traits are unpleasant for others. There are three overlapping types of dark personality traits known as the dark triad. The triad (i.e., group of three) consists of Machiavellianism, psychopathy, and narcissism. There is a total of 27 statements in this test, and the respondent answers on a scale from 1 (strongly disagree) to 5 (strongly agree).

The NEO Five-Factor Inventory (NEO-FFI) was developed by Costa & McCrae (1985, 1989, 1992, 1995). NEO-FFI is a revised version of NEO-PI-R (Costa, McCrae (1991) with 60 items used for testing statements, where the subject assesses the degree of adequacy of statements for his personality, again on a five-point scale. The method determines the degree of individual differences according to the five-factor theory and provides data on five general dimensions of personality: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. Over the past two decades, the Five-Factor Model has become a dominant paradigm in personality psychology. Costa & McCrae (1995) focused on these five general dimensions of personality, neglecting other traits.

The SPARO test (Mikšík, 2004) is the basic tool of the DIAROS diagnostic toolbox. It is a redesigned and further developed variant of the SPIDO - IHAVES - VAROS - IHARO - IHATRANS series. It consists of 300 questions to which the subject answers yes or no by recording answers in a record sheet. The subject must always lean towards one of the two answers. In case of a difficult decision, it records this difficulty with a more pronounced dot at the cross.

The SPARO test assesses the basic components of basal-mental integration: cognitive, emotional, regulatory, and adjustment

variability. More basal scales of general variability include the general level of mental (internal) arousal and spontaneity and motor (or external) momentum.

For a deeper insight into the individual characteristic specifics of basal self-regulation of personality, other tested personality traits are integrated into more comprehensive dimensions: N, S, R, I, V, K and P. Dimension N, which measures the features of normality, includes relationships, suspicion, mental lability versus mental stability, and personality anomalies and extremity. Dimension S, which measures the optimal level of stimulation, includes sensory impression, intensity of inner experience, movement restlessness, dynamics of interaction with the environment, social disinhibition, and the general stimulation level. Dimension R, which measures the individual tendency to take risks, includes level of aspiration, level of anticipation, whether the person tends to rely on chance, social exhibitionism, and the general level of acceptance or rejection of risky activities. Dimension I, which measures the effective integration of personality, includes anxiety, emotionality, and effective capacity of reason, level of resistance to disturbing stimuli, and level of effective personality integration. Dimension V, which measures interpersonal relationships and ties, includes closedness versus connectivity, level of benevolence and tolerance, compliance and tendency to independence. Dimension K, which measures internal correction and regulation of interactions, includes rigidity versus flexibility, recklessness versus responsibility, detachment versus homestead, frustration versus directionality, and correction versus impulsivity. Dimension P, which measures self-promotion, includes suppression versus high self-confidence, stubbornness versus optimism, experiential versus responsive approach, inconspicuousness versus self-assertion, and a feminine versus masculine type of interaction.

The questionnaire included two types of criteria of credibility (or relative reliability) for the respondent's answers. The first is to assess the relationships between the results on the scales to affect a certain set of the aforementioned features and the results specifically created. For truthfully completed questionnaires, the scales for general stimulation level, general level of acceptance or rejection of risky activities, and dimension of effective personality integration must be characterized by the nature of the deviation of central values of the comparable population, which results from the trend of deviations in the set of features entering this dimension. The second criterion is the so-called K-score of extreme statements, which verifies the significance of disproportions in relations between the aforementioned scales traditionally according to the concept of 'lie score'.

The Golden Profiler of Personality (GPOP) test from Golden (2005) is based on the MBTI method (Myers, McCaulley, 1985) that has its origin in Jung's typology, enriched with the fifth dimension of personality: disposition to stress. The authors of the German version of this questionnaire presented GPOP as one of the most serious and respected tools in the field of human resources, executive education, and management and organization: "GPOP opens access to complex relationships of each person, team, company". The name GPOP was introduced for distribution to the European market, while the questionnaire is known worldwide as the Golden Personality Type Profiler (GPTP).

The GPOP is a 116-item questionnaire. Its results are captured in ten global scales grouped into five pairs: extraversion / introversion, senses / intuition, thinking / feeling, decision orientation / perception orientation, and tension / relaxation. Each scale has several subscales.

The questionnaire contains five pairs of scales, each of which has five subscales. The first pair scale, extraversion (E) / introversion (I), captures the source of an individual's psychic energy. This scale has the following subscales: 1. vigour / calmness; 2. orientation to society/privacy; 3. sociability / discretion; 4. entrepreneurship/reluctance; and 5. spontaneity / judiciousness. The second pair scale, senses (S)/intuition (N),

indicates the way of perceiving reality. The subscales are: 1. practicality/innovation; 2. specificity / abstractness; 3. realism / imaginativeness; 4. rewards specific / rewards abstract; and 5. stability / change. The third paired scale, thinking (T) / feeling (F) indicates the process of decision-making. It has subscales: 1. distance / empathy; 2. objectivity / subjectivity; 3. autonomy / authenticity; 4. leadership/adaptability; and 5. criticality / acceptance. The fourth paired scale, decision-making orientation (J) / perception orientation (P) indicates the lifestyle of an individual. The decision-making orientation speaks to a style that has order and is organized and structured. Conversely, the orientation to perception speaks of immediacy, flexibility, and adaptation. It has the following subscales: 1. focus on the goal / process; 2. structuredness / impulsivity; 3. reliability / looseness; 4. sense of detail / whole; 5. stability / openness to opportunities. The last pair, tension (A)/relaxation (G), refers to how an individual responds to stress. It has five subscales: 1. scepticism / credulity; 2. uncertainty / equanimity; 3. caution / audacity; 4. negative / positive attunement; and 5. pessimism / optimism.

The output is 16 personality types: ISTJ, ISFJ, INFJ, INTJ, ISTP, ISFP, INFP, INTP, ESTP, ESFP, ENFP, ENTP, ESTJ, ESFJ, ENFJ, and ENTJ.

The Coping Strategies Questionnaire (SVF-78) by Janke and Erdmann (2002) is an abbreviated new version of the original SVF questionnaire. In the SVF-78 version, 13 scales are: S1– underestimation; S2– denial of guilt; S3– deviation; S4– substitute satisfaction; S5– situation check; S6– control of reactions; S7– positive self-instruction; S8– the need for social support; S9– avoidance; S10– escape tendency; S11– perseveration; S12– resignation; and S13– self-blame.

3 Results

A total of 121 scientific variables were formulated based on experts' estimation, to investigate the dependence of the level of strategic thinking (measured using results of the Strategic Thinking Self-Assessment test) on specific personality traits (evaluated using the sub-components of individual personality tests or the components of the SVF-78 test).

The methods of descriptive statistics, analysis of variance with tests of hypothesis, and correlation analysis were used for the study. STAGHRAPHICS Centurion XVIII software was used for statistical analysis.

The results of the descriptive statistical analysis of the Strategic Thinking Self-Assessment test showed that the lowest value was 5.4, the mean was 7.4, the median was 7.4, and the mode was 7.3. As mentioned above, after recalculating the data, these results correspond to the category 51–77: adequate (You know and practice many basics of strategic thinking. However, you can increase your success by further expanding your skills). Then, the variables were established about the relationship between the dependent variable (strategic thinking) and the independent variables (subtests of personality tests and the SVF-78 questionnaire). Regression analysis was used to analyse this relationship at the significance level $\alpha = 0.05$.

According to the results of F-statistic and P-value, we either accept the null hypothesis (H0) or reject it in favour of the alternative hypothesis (H1) If the alternative hypothesis (H1) is accepted, then the strength of the dependence relationship (correlation, Pearson correlation coefficient) is examined. For correlation, more parameters were included, namely R-squared in percentage, R-Squared adjusted for d.f. in percentage, the standard error of estimation and t-test. The R-Squared statistic indicates the percentage that a fitted model explains in terms of the variability in the dependent variable after transforming to a logarithmic scale to linearize the model.

Of the 121 variables, 18 variables were accepted, confirming the dependence of the degree of strategic thinking on specific individual personality traits. As for the intensity of the dependence relationship, it was relatively weak in 16 and

moderately strong in 2 variables. The following tables present the research results and their statistical derivation. The results in Table 1 show relatively weak relationships between the level of strategic thinking and:

- from SD3: machiavellianism;
- from NEO-FFI: conscientiousness;
- from SPARO: emotional variability, personality anomalies, extremity, general stimulation level, and suppression versus high confidence;
- from GPOP: intuition, abstract rewards, change, authenticity, sense of the whole, uncertainty, and release and positive mood;
- from SVF-78: resignation; and moderately strong relationships;
- from SPARO: the general level of acceptance or rejection of risky activities;
- from GPOP: optimism.

Table 2 shows the results of analyses where the relationship between the examined variables was not confirmed, with a P-value of 0.05. If an analysis of dependence were performed with a recommended P-value lower than 0.0001, then only one hypothesis would be confirmed – a moderately strong relationship between the level of strategic thinking and SPARO: the general level of acceptance or rejection of risky activities. For this reason, we performed an analysis of the dependence on the significance level $\alpha = 0.05$. All gained results are displayed in Appendices 1 and 2.

4 Discussion and Conclusions

As already mentioned, the extant literature lacks a comprehensive analysis of the relationship between personality types according to various standardised questionnaires and levels of strategic thinking among managers. There are studies dealing with the results of analyses of relationships between personality types and other managerial competencies.

Significant studies include Sieff & Carstens (2006) investigated the relationship between personality type and leadership. The results of the study show that the five Leadership Focus Questionnaire (LFQ, developed by the authors) first-order factors and two second-order factors, seven factors in all, were correlated against the four attitudes (Extraversion, Introversion, Judging and Perceiving), and the four processes (Sensing, Intuition, Thinking and Feeling) of the Myers-Briggs Type Indicator instrument using the Pearson Correlation Coefficient to determine any statistically significant relationships.

The relationship between leadership style and the level of strategic thinking studied Bajcar, Babiak, & Nosal (2015). They based their research on Fiedler's theory (1971) as guidance aimed at investigating the relationships between thinking and behavioural strategies and leadership styles (as strategic thinking indicators) to explore existing interdependencies among them. The main findings of the research include those values of path coefficients leading from strategic thinking factors to structuring style, indicating that this leadership style is determined to a more significant extent by thinking-oriented strategies than by behaviour - oriented strategies. Other significant research findings included that structuring style mediates the relationships between thinking and behaviour - oriented strategies and produces positive effects on disciplinary behaviours - controlling style, rewarding style and a participative style and negative effects on behaviours leading to absenteeism in leadership processes, expressing in distant style.

Newcomer & Connelly (2020) were partially engaged in similar research - investigated personality type by MBTI and leadership and their potential impact on the level of strategic thinking. However, their research took place in a specific environment, namely with military officers (Adult male and female officers from around the world were used for this study; however, most of the officers surveyed were US officers—most of which were US Air Force-affiliated.). They discuss their partial results with

the work of Bullis (2009). The first conclusion from the above statistical results and discussion relates to the topic of conformism - intellectual conformism is likely to have significant drawbacks, even without consideration of the complex, uncertain, and ambiguous operational and strategic environments found today in every geographic command. A second consideration is the possible deeper meanings behind a high concentration of S-F-Js in military populations. Bullis argues that working in the military requires the practice of N-F-P preferences in cognitive and leadership behaviour, that strategic thinkers need to "discover underlying interdependent or reciprocal relationships (N)," "place primacy on the interpersonal component of their interactions (F)," and "apply patient decision-making techniques (P)." However, their results showed that they had a higher proportion of S-F-J personalities in the sample. In the results, they discussed how this affects the need to think strategically.

The research results fill a significant gap in investigating the relationship between personality types according to various standardised questionnaires and levels of strategic thinking among managers. The results of this study show a relationship between a higher level of strategic thinking and specific personality dimensions according to various standardised tests conducted on 121 variables, of which only 18 were confirmed. Suppose these results can be repeated every year. In that case, the resulting data can be generalised, thus enabling us to identify how a higher level of strategic thinking depends on selected individual personality traits.

The study has the following limitations. Although a representative research sample was obtained in all study groups, these results cannot be assumed as generally valid for all managers. Thus, the research team decided to continue the study and test new managers in security environment. The findings could provide valuable insights to practitioners regarding enhancing the assessment of strategic thinking in existing competency models by incorporating personality dimensions.

Suppose the results of this research are confirmed in the coming years. In that case, a new test for objective evaluation of the level of strategic thinking can be developed by incorporating personality dimensions in the existing competence models. Furthermore, future research can extend the results of this study by identifying the relationship between strategic and critical thinking levels.

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Primary Paper Section: A

Secondary Paper Section: AE, KA

Appendix 1

Table 1. Proven dependencies of strategic thinking on other variables and intensity of the dependence

	Analysis of variance			Correlation					
	F	P	Result	R2	R2 adj.	Std.er.	T	Correl.	Intensity
M – Machiavellianism	7.16	0.01	H1	12.751	10.970	13.962	-2.762	-0.35709	relatively weak
Resignation	4.48	0.0394	H1	8.37563	6.50575	14.3074	-2.11642	-0.28941	relatively weak
Conscientiousness	6.23	0.016	H1	11.28945	9.47399	14.0685	2.49655	0.335924	relatively weak
Emotional variability	4.67	0.0357	H1	8.6955	6.83214	14.2723	-2.16023	-0.29488	relatively weak
Personality anomalies	6.6	0.0133	H1	11.868	10.0694	14.0321	-2.56874	-0.3445	relatively weak
Extremity	7.25	0.0097	H1	12.8855	11.1076	0.386158	-2.69218	-0.35896	relatively weak
General stimulation level	6.22	0.016	H1	11.2696	9.45882	1.26055	-2.49469	-0.3357	relatively weak
General level of acceptance or rejection of risky activities	28.97	0.0000	H1	37.1557	35.8732	0.327616	-5.38242	-0.60956	moderately strong
Suppression versus high confidence	4.29	0.0437	H1	8.04683	6.17023	14.3331	2.07075	0.283669	relatively weak
Intuition	4.98	0.0302	H1	9.22812	7.37563	14.2407	2.23192	0.303778	relatively weak
Abstract rewards	5.98	0.0181	H1	10.8835	10.8835	14.1103	2.44627	0.329902	relatively weak
Change	4.07	0.0493	H1	7.66232	5.77788	14.3528	2.01646	0.276809	relatively weak
Authenticity	4.42	0.0407	H1	8.27432	6.40236	14.3153	2.10242	0.287651	relatively weak
Sense of the whole	6.94	0.0112	H1	12.4116	10.624	13.9888	-2.63504	-0.3523	relatively weak
Uncertainty	7.32	0.0094	H1	12.9956	11.22	13.942	2.70536	0.360494	relatively weak
Release	6.39	0.0147	H1	11.5431	9.73786	14.0579	2.52868	0.339751	relatively weak
Positive mood	7.36	0.0092	H1	13.0639	11.2897	13.9366	2.71352	0.36144	relatively weak
Optimism	16.66	0.0002	H1	25.3745	23.8515	12.9122	4.08181	0.503731	moderately strong

Source: own work by authors

Appendix 2

Table 2. Results of analyses where the relationship between the examined variables was not confirmed

<i>X (independent)</i>	Analysis of variance			<i>X (independent)</i>	Analysis of variance		
	F	P	Result		F	P	Result
Narcissism	2.60	0.1131	H0	Extraversion	2.07	0.1567	H0
Psychopathy	0.17	0.6804	H0	Vigour	1.7	0.1986	H0
Underestimation	2.56	0.1161	H0	Orientation to society	1.78	0.1878	H0
Denial of guilt	1.12	0.2961	H0	Sociability	0.13	0.7191	H0
Departure	0.9	0.3484	H0	Entrepreneurship	0.61	0.4373	H0
Substitute satisfaction	2.74	0.1043	H0	Spontaneity	2.93	0.0931	H0
Checking the situation	1.42	0.239	H0	Introversion	0.41	0.5256	H0
Reaction control	3.66	0.0614	H0	Calmness	1.11	0.2966	H0
Positive self-instruction	1.59	0.2136	H0	Orientation to privacy	0.88	0.3528	H0
The need for social support	2.39	0.1282	H0	Discretion	0.25	0.6196	H0
Avoidance	0.61	0.4404	H0	Reluctance	0.12	0.7292	H0
Escape tendency	2	0.1641	H0	Judiciousness	0.84	0.3636	H0
Perseveration	0.63	0.4312	H0	Senses	0.42	0.5217	H0
Self-blame	3.41	0.071	H0	Practicality	0.82	0.3697	H0
Neuroticism	1.39	0.2443	H0	Specificity	2.4	0.1281	H0
Extraversion	2.34	0.1327	H0	Realism	0.57	0.4537	H0
Openness to Experience	1.22	0.2757	H0	Rewards specific	3.48	0.0683	H0
Agreeableness	1.75	0.1918	H0	Stability	0.13	0.7169	H0
Cognitive variability	0.34	0.5634	H0	Innovativeness	1.97	0.1669	H0
Regulatory variability	0.18	0.6724	H0	Abstractness	0.53	0.4682	H0
Adjustment variability	0.2	0.6551	H0	Imaginativeness	3.13	0.0829	H0
General level of mental (internal) arousal, spontaneity	0.48	0.492	H0	Thought	1.34	0.2518	H0
Motor (or external) momentum	1.32	0.2561	H0	Distance	2.74	0.1044	H0
Relationships. suspicion	0.38	0.5401	H0	Objectivity	0.24	0.628	H0
Mental lability versus mental stability	3.07	0.0862	H0	Autonomy	0.32	0.5759	H0
Sensory impression	0.39	0.5374	H0	Leadership	0.13	0.7244	H0
Intensity of inner experience	1.68	0.2009	H0	Criticality	1.45	0.2345	H0
Movement restlessness	0.71	0.4021	H0	Feeling	2.14	0.1499	H0
Dynamics of interaction with the environment	0.1	0.7563	H0	Empathy	0.44	0.5117	H0
Social disinhibition	0.85	0.3613	H0	Subjectivity	2.14	0.1502	H0
Level of aspiration	0.18	0.6692	H0	Adaptability	0.48	0.4912	H0
Level of anticipation	0.87	0.3558	H0	Acceptance	0.92	0.3431	H0
Tendency for relying on chance	1.88	0.1761	H0	Decision orientation	2.07	0.1563	H0
Social exhibitionism	0.99	0.3242	H0	Target focus	4.04	0.0501	H0
Anxiety	0.6	0.4413	H0	Structuredness	2.08	0.1559	H0
Emotionality	2.41	0.1267	H0	Reliability	2.27	0.1387	H0
Effective capacity of reason	2.78	0.102	H0	Attention to detail	1.89	0.1757	H0
Level of resistance to disturbing stimuli	0.85	0.36	H0	Stability	1.19	0.2812	H0
Dimension of effective personality integration	0.99	0.3234	H0	Orientation to perception	0.18	0.6771	H0
Closedness versus connectivity	2.35	0.1317	H0	Focus on process	0.11	0.7413	H0

Level of benevolence and tolerance	0.86	0.3586	H0	Impulsivity	1.21	0.2765	H0
Conformity	1.5	0.2272	H0	Looseness	0.49	0.4872	H0
Tendency for independence	0.38	0.5385	H0	Openness to opportunities	0.13	0.7215	H0
Rigidity versus flexibility	1.49	0.2277	H0	Tension	3.18	0.0807	H0
Recklessness versus responsibility	0.63	0.4298	H0	Scepticism	1.79	0.1868	H0
Detachment versus homestead	1.11	0.2969	H0	Caution	1.32	0.2558	H0
Frustration versus directionality	1.39	0.2438	H0	Negative attunement	0.49	0.4894	H0
Correctness versus impulsivity	0.38	0.5411	H0	Pessimism	1.91	0.1736	H0
Stubbornness versus optimism	1.64	0.2066	H0	Credulity	2.95	0.092	H0
Experiential versus responsive approach	2.55	0.1168	H0	Equanimity	2.81	0.1001	H0
Inconspicuousness versus self-assertion	0.65	0.4251	H0	Audacity	3.53	0.0662	H0
Feminine versus masculine type of interaction	1	0.3224	H0				

Source: own work by authors

THE EFFECTIVENESS OF INVESTMENTS IN HUMAN RESOURCES AS A TOOL PROMOTING COMPANIES' HUMAN CAPITAL FORMATION: QUALITATIVE SURVEY OF CZECH BUSINESSES

^aJAN URBAN

^a*Faculty of Corporate Strategy, Institute of Technology and Business in České Budějovice, Okružní 517/10, 370 01 České Budějovice Czech Republic email: "21537@mail.vstecb.cz"*

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: "Human capital" is not only an important part of a company's intangible assets, but also a value whose share in the structure of total company assets is growing over the long term. Professional management of human resources, which contributes to its formation, thus increasingly acquires the role of an important function capable of both directly and indirectly contributing to increasing the market value of the company. The prerequisite is his ability to focus investments in human resources in the right direction and guarantee their effectiveness, i.e., the return on human resource investment. The article deals with the growing importance of human capital and its reasons, its components and methods of its creation. Its main focus lies on factors promoting the effectiveness of human resource investments, its indicators as well as on conditions and circumstances contributing to its increase. Using the method of a qualitative survey, it aims to find out, to what extent is the issue of HR investments' effectiveness taken into consideration by mid-sized and bigger companies in the Czech Republic in their HR capital formation and which methods do these companies use to promote these characteristics.

Keywords: Human Capital, Public Corporations, HR Management, Investing in Human Resources and Its Effectiveness, Returns on Investing in HR, Factor Promoting HR Investment Effectiveness

1 Introduction

One of the distinct trends concerning the economics of corporations of developed countries, which has been more and more transparent for about 30 years, is the increasing share of the value of their intangible assets within their total (market) value (Anghel, I., 2008; Bechtel, R., 2007; Boekestein, B., 2006). Due to its nature, however, this fact can only be proven rather indirectly, but it is vividly captured by the example of the American economy, where the availability of range of indirect data testifying to this trend is the largest.

While 30 years ago, the market and book value of the 3,500 largest American companies were practically equal, twenty years later the book value of these companies represented already less than thirty percent of their market value (Ciprian, G.G., et al., 2012). In the case of the 500 largest companies, evaluated by Standard and Poor's, their accounting value, including primarily the value of equipment and inventory, corresponded to only one-sixth of their market value at that time. The decisive part of the total value of the companies was thus created by the (at first glance) hidden value of their intangible assets (Pasban, M.R., & Nojedeh, S., 2016). In the following years, this trend continued (Yosof Boroujerdi, R., et al., 2020).

Intangible assets of a company represent a part of its value that is not directly related to its tangible or physical assets recorded in the company's balance sheet (Kalitanyi, V., & Goldman, G.A., 2021). They include the results of its research and development, the files of its regular customers, the value of its well-known brands, but also the value of the knowledge, skills, motivation and loyalty of its employees, including the value brought to the company by the way its employees are managed, which contributes to the aforementioned assumptions. Within the last category, i.e., the value that the method of managing its employees has for the company, mainly those methods of human resource management are important, which are difficult for other companies to imitate, due to the specific know-how on which they are based (Hayton, J.C., 2004).

The collective term for this value is the company's human capital, which is created by the company by investing in human resources, primarily through education, training and the

development of human resource management methods that increase employee productivity, or production quality.

An important consequence of the aforementioned trend is that the value of large corporations (and above all the value of the most successful of them) can no longer be derived only from the items included in their balance sheet, i.e., from its balance sheet value or amount. The traditional balance sheet indicators of a company's assets capture only part of the information that is needed for its market evaluation, which is most often carried out on the basis of its market capitalization, i.e., the total value of its shares on the stock exchange.

In order to fill the corresponding "information gap", i.e., understanding the difference between the company's balance sheet (book) and market values (its market capitalization), which today business owners are beginning to call for, information about the company's intangible assets, including its human capital, is needed (DiBernardino, F., 2011).

This information is not yet regularly published by companies (for example in their annual reports) but its publication is on the rise, with a clear goal - to interest investors and indicate the reason why the market value of the company is higher than its accounting value. The main emphasis is usually put on indicators related to employee performance management; indicators used to inform about these methods cover usually the following (mutually related) metrics: share of company employees with an approved personal performance plan (with set personal performance goals), the proportion of managers with an approved personal performance plan, share of company employees with an approved personal development plan, share of managers with an approved personal development plan, the proportion of employees and managers undergoing regular performance evaluations, share of development activities completed in accordance with the plan, share of development activities that met their goals, etc. (Krausert, A., 2016).

Other, less frequently publicized information concerning methods of methods and results of human resources management, cover their selection, development, remuneration, methods of communication with employees, occupational safety, employee satisfaction, the share of women in the total number of senior employees, etc.

A similar, sometimes even more important change as that concerning the increasing share of the intangible assets within the total (market) value of companies appears to develop in the relation between the market value of companies on the one hand and their profits on the other. The fact is that this relationship is gradually weakening (Crass, D., & Peters, B., 2014).

Put in other words, two businesses operating in the same industry and earning nearly the same profits can have significantly different market values (Hajrullina, A.D., & Romadanova, O.A., 2014). Again, the reason behind this development are different intangible assets of these companies. These assets are namely an important factor in the confidence of business owners in the future company including its future profits.

This phenomenon can be illustrated on a simple example using P/E (price-earnings ratio) indicators. The P/E ratio is defined as the ratio of a company's share price to earnings per share. For example, if the share price of a certain company reaches the value of CZK 60 and its profit per share is at the level of CZK 3, then the P/E indicator will be equal to twenty (60/3). Practically, this means that the investor, buying the shares of the given company, is willing to pay twenty crowns for every crown of profit of the given company. If the company's P/E is lower, for example 17, it means that investors are willing to pay only CZK

17 for one crown of the company's profit at a given moment. Their confidence in the company as an investment opportunity is lower.

What follows from the above, in the case of publicly traded companies with at least a medium-term financial history, is that the development of their intangible capital can be evaluated/estimated by comparing the development of their profits with the development of their share prices or their total market value. If the development of the company's stock price is faster than the growth of profits, the intangible assets of the company are growing which is reflected in the growth of the company's stock price. Conversely, if the development of the company's share price is slower compared to the development of profit, it means that the value of the company's intangible assets is decreasing.

For corporate management whose financial compensation is related to the development of the share price, or the market value of the firm, this has a fundamental consequence. The management of a company whose share price growth is developing more slowly than its earnings growth may have a number of plans to increase corporate profit, but if it is not able to increase the company's intangible assets to be reflected in the P/E ratio, its shareholders are too they will not be satisfied, and this circumstance may also be reflected in the development of corporate management remuneration.

2 Theoretical background

Intangible assets, representing the decisive source of a company's market value, do not include the value of its human capital only (Hilorme, T., 2016). They can include the value of company patents, copyrights and protected trademarks, its goodwill (reputation on the market), loyalty of its customers, etc. The quality of the company's human resources, their abilities, motivation and work commitment, as well as the effectiveness of their management, for example the effectiveness of their development, performance-based remuneration, etc., are not only an important part of intangible assets as such, but also an important prerequisite for the growth of the value of other assets that fall into this category (Cucaro, O., 2017; Seo, H., & Kim, Y., 2020). The reason is that the prerequisite for the creation and development of intangible assets are the abilities of employees and managers (Afiouni, F., 2013).

As a rule, the intangible assets of the company are monitored/classified primarily according to their material nature. From the human resources and their capabilities, they can, however, be divided into four even more basic categories (Iwamoto, H. & Takahashi, M., 2015). According to most authors (Lin, C., 2017; Mayo, A., 2016), they consist of:

- credibility of the company and its management. Its prerequisite or decisive factor is its ability or habit to keep promises, to create favourable but at the same time realistic expectations of further company development, as well as the ability to maintain and develop the good reputation of the company in relation to its owners, business partners, customers and employees. Keeping promises in relation to partners or stakeholders facilitates business relations, improves relations with customers, increases the motivation and loyalty of employees and prevents the emergence of conflicts in relations with the external environment of the company (Zeb, A., et al., 2018),
- a clear and convincing strategy for the future development of the company, showing how the company will continue to develop (innovate its products, expand its markets, strengthen its competitiveness, etc.), and thus increase its value. A convincing strategy creates confidence in the future development of the company, both on the part of investors and employees (Lenihan, H., 2019),
- professional and technical skills necessary to implement the corporate strategy. The company's research and development, production knowledge and technology, sales,

marketing and logistics procedures, quality control, etc. contribute to their creation (Subramony, M., et al. 2021),

- the organizational and management capabilities of the company including, above all, the managerial and leadership qualities of its senior managers, reflected in the smooth cooperation among individual parts of the company, in the company's ability to innovate and implement changes, quickly introduce new products and services to the market, shorten the product cycle, develop and use one's talents, to behave responsibly towards customers, etc. They also include the way of managing and developing individual employees, especially setting their goals and evaluating their work, creating appropriate corporate culture, etc. These factors are then reflected in the company's ability to acquire and retain the most capable workforce in its industry (Kucharčíková, A., & Mičíak, M., 2018).

Intangible assets, linked to the capabilities of human resources, including the capabilities of the company's management team, contribute to the overall competitiveness of the organization as well as its unique identity (Hamadamin, H.H., & Atan, T., 2019; Ližbetinova et al., 2022). The reason is that these assets can only partly be imitated by competing entities, unlike, for example, products or technologies (Handayani R., 2020). Deficiencies in these assets, however, do understandably have the opposite effect, and can lead to a decrease in the overall value of the company.

Investing in human capital

The abilities summarized in the categories mentioned above cover not only the main components of the company's human capital, but also the main directions in which human resource management can contribute to its creation, thereby contributing to the overall value of the company (Kalita, K., & Das, A., 2022, Hitka et al., 2021). The importance of personnel management in the creation of these intangible assets corresponds to the long-term shift of its role from an administrative function without greater added value to a function whose added value is substantial (Al-Ghazawi, M., 2006, Skýpalová et al. 2022). This corresponds to the requirement, based on the experience of companies with successful creation of human capital, that these activities, in a rough estimate, should, timewise, cover approximately 60% of human resources management activities (Iwamoto, H., & Suzuki, H., 2019).

Human resources managers or specialists do often have difficulties analysing HR management activities in terms of financial indicators, in a way which is common in other areas of business management (Hidayat, M., 2018). The reason is not only the more difficult financial capture of personnel aspects of management, but also the fact that the benefits of HR management measures are usually not immediate but, in contrast to their costs, rather long-term. However, the logic of investing in human resources is inexorable. If increasing investments in human resources are to be reflected in an increase in human capital as well as the of the corporation overall value, their effectiveness must be evaluated (Mahmudah, F., et al., 2017; Roca-Puig, V., et al., 2019; Jurasek et al., 2021). The returns of these investments have thus to be based on similar or even the same rules as the evaluation of other companies' investment expenses (Mihardjo, L., et al., 2020).

Expressed in other words, if HR professionals are to be able to objectively justify their investment and/or HR measures proposals (e.g. proposals regarding the introduction of competency models for individual jobs, performance management systems, career planning, e-learning, etc.) the planning and evaluation of these investments should be based on the usual principles of cost/benefit analysis, including the analysis of risks with which these expenses and corresponding measures may be associated (Jacobson, W.S., et al., 2014; Park, S., et al., 2017; Zakharova, O., & Kratt, O., 2014).

This applies in spite of the fact that the calculation of costs, and, above all, estimating the benefits of personnel expenses and

measures, encounters certain technical difficulties. There are, however, basically five options (criteria) for evaluating the results of personnel programs or measures which differ in how demanding a criterion they use to evaluate the benefit of a certain measure. Their practical use is usually related to how accurately the results of this measure can be determined, or quantified. Individual methods of evaluating the results of personnel measures can also be combined. During the implementation of a certain measure, especially if its costs are increasing, verification of its effectiveness may require to use a more demanding criterion (Mondore, S., et al., 2011).

The simplest, but also the least accurate, criterion for their evaluation consists in ascertaining the reaction of managers and employees to its proposal or in verifying their satisfaction with its benefits. An example could be a survey prior to the introduction of a new remuneration system asking a question such as: *"Do you think that this remuneration adjustment will lead to the fact that the attention of employees is more focused on the main goals of their workplace?"* Another frequent example can be the evaluation of the benefits of a training event by its participants or managers' satisfaction with the results of the new adaptation program.

A benefit analysis based on an oral or written survey of employees related to this measure may be sufficient to evaluate a number of HR programs or measures. It is particularly suitable for shorter programs or less financially demanding measures, as well as in situations where the satisfaction of employees or managers with a given measure (for example, evaluation of its fairness, appropriateness, ability to facilitate work, etc.) is very important for its success.

The second evaluation option is based on the assessment of results in the form of newly acquired knowledge and information that a certain new personnel measure brought to the employees (Schneider, M., 2018). An example could be the verification of the benefits of the training program based on a test of the knowledge that the employees have acquired, or the verification of the knowledge about the company that the newly hired employees took away from the completed adaptation program. The use of this criterion is appropriate if the acquisition of certain specific knowledge or information is very important for employees in terms of the correct performance of their work or their motivation.

The third, more demanding way of verifying the results of personnel programs is based on the assessment of whether the measures lead to changes in the behaviour of employees. An example can be finding out whether employees use newly acquired information or skills in practice and whether they are able to develop them further.

If personnel programs or measures require significant investments, previous methods of verifying their results may be perceived as insufficient. In this situation, the management of the company may request that more demanding methods be used to verify their effectiveness. The solution is to use the fourth or fifth method of evaluating the results of personnel measures. The fourth level of verifying the effectiveness of personnel investments or measures consists in determining their impact on measurable performance indicators. Examples can be savings achieved, increased productivity, reduction in the proportion of waste, etc. Evaluation of this type may come into consideration, for example, when assessing the results of a program aimed at increasing employee satisfaction.

The fifth and most demanding level of evaluation of the effectiveness of personnel measures focuses on the direct measurement of their financial return using the ROI indicator (Bontis, N. & Fitz-enz, J., 2002; Ben-Gal, H.C., 2019). This requires fully defining the costs and benefits of the measures in financial terms and comparing them with each other (Iwamoto, H. & Suzuki, H., 2019).

Due to the barriers of personnel measurements, the use of the fourth and fifth approaches is limited to only some situations (Rauf, A., Gulzar, S., & Baig, J., 2017). However, it should be used for measures where verification of their contribution to business performance is important. These are measures with a long-term lifespan, measures important for achieving the company's strategic goals (for example, to increase customer satisfaction, reduce the rate of absenteeism or turnover, etc.), programs that require not only significant financial but also time costs (for example, extensive development programs, employee benefit programs to retention of key employees, 360-degree evaluation, etc.) and measures that require increased attention from employees and managers. Other examples of measures whose results should be evaluated by these approaches include career planning, competency models, adaptation programs, development and coaching of managers, performance reward systems, or remuneration based on abilities, implementing organizational changes, recruitment and selection strategies, programs to increase employee stability, TQM programs, etc.

The use of these methods, on the other hand, is not suitable in situations where personnel measures are based on legislative requirements or are otherwise necessary, or if they would create the impression that the organization focuses only on their financial evaluation. Examples can be personnel measures that strengthen the ethical behaviour of employees, prevent discrimination, etc.

3 Methodology and Data

The purpose of the article, based on a qualitative analysis using management questionnaires and semi-structured interviews, mainly with human resource managers of mid-sized and bigger businesses, was to find out what importance do the companies surveyed put on efforts to maximize their intangible assets, to what extent do they strive to increase the effectiveness of their human resource investments contributing to the human capital formation of their companies, and which methods they use to achieve this goal.

More specifically, the research questions covered the following issues

- (i) do the companies surveyed deliberately try to increase their human capital as a measure increasing the value of their intangible assets,
- (ii) do the companies surveyed deliberately try to increase their human capital, and, if yes, which means do they use for their HR capital formation,
- (iii) do the companies surveyed strive, in an effort to build-up the HR capital, to evaluate and/or increase the effectiveness of their human resource investments and what methods – if any – do they use to raise their rentability.

Data collection was carried out in the second half of 2022, using simple random sampling and the units of sampling were companies operating mainly in central Bohemia. A total of 45 companies were included in the research whereby the majority of firms surveyed were either limited liability companies or joint-stock corporations. The number of employees in these companies ranged from 350 to 860 persons, and most of the companies operated in manufacturing, logistics and trade industries.

4 Results

The analyses of the research questions which followed from the questionnaires answers and interviews statements were the following:

- (i) most companies surveyed did not deliberately try to increase their human capital as a measure increasing the value of their intangible assets. Only 16% of the companies surveyed claimed that intangible assets are a matter of importance for them. Most companies (64%) did, however, according to their managers tried to increase their HR

capital, the main reason for this being the increase of their productivity and rate of innovations. Some managers, expressed, however, a concern that an increase in HR capital of their employees could lead to an increase of their employees' turnover,

- (ii) unlike the components of HR capital stated in literature, most managers (79%) associated human capital with the capabilities, knowledge and expertise of the employees only. The rest of managers surveyed understood this notion as term including also employees' motivation and loyalty. Methods of HR management were not regarded as a component of HR capital. As the main means of HR capital formations (in 69% of the companies surveyed) were regarded various forms of HR training and development.
- (iii) only a minority of the managers/companies surveyed strived to take active steps to increase the effectiveness of HR investments. About one third of companies surveyed, however, did so, though most managers interviewed admitted that it is usually much more difficult to enforce the analysis of costs, revenues and risks in the personnel area, mainly because traditional indicators of "results" or "efficiency" of personnel management measures have traditionally focused primarily on the list or scope of HR activities performed. As examples, indicators like the number of days needed to fill a vacancy or the number of people who have completed a certain training program (and not an indicator of the percentage of those who have completed the course successfully) were quoted.

Interview managers thus claimed that though traditional personnel indicators do undoubtedly have their meaning, they do not allow evaluating the real impact of personnel expenses or processes on business performance and/or human capital nor do they allow assessing the effectiveness of alternative HR tools or measures.

Approximately one third of companies questioned stated, however, they try to plan and subsequently evaluate the return on investment in human resources or newly implemented HR measures. At the same time, HR managers of companies that take steps in this regard, stressed that efforts in this area must be based on five basic steps. These steps include:

- clear determination of the goal or goals to be achieved on the basis of the planned investment or measure
- stating the planned and calculating the actual costs, both direct and indirect, initial (immediate) and ongoing, associated with the proposed measure and their comparison with existing costs
- determination, or subsequent assessment of the results/benefits of personnel investments and measures, both immediate and longer-term
- determination of indicators of return on investment in human resources
- determination of risk factors and success factors that can affect the expected expenses and benefits of the intended measures, and determination of ways in which these risk factors can be limited or neutralized.

The main recommendations concerning the above-mentioned points emphasized in the interviews were the following:

Goals of intended of measures

The companies with most experience in promoting HR investment effectiveness emphasized that the starting point for justifying any investment or measure is determining the main meaning of the proposed change. It includes an explanation of the business need that gives rise to it and an indication of how the proposed measure addresses this need. The ability of personnel measures to respond to business needs and goals is key to the effectiveness of resources spent in the field of human resources. If these measures are created without regard to corporate strategy, they can have a negative impact on corporate efficiency, even if they are otherwise implemented correctly.

Examples quoted. The company's effort to respond to employee dissatisfaction with the method of their evaluation, for example

its bias, can lead to a proposal for training managers in impartial evaluation. However, managers may be well aware of the unfairness of evaluations, but may not be motivated to do so. Their training is therefore not an adequate solution. Similarly, trying to solve a certain problem (for example, increased employee turnover) by eliminating its seemingly "clear cause" (for example, low salaries) may not be the most effective. Employee turnover is often low even in companies with relatively low wages.

Generally, the main goal of the proposed measure may be to reduce costs, increase production capacities, increase productivity or other performance criteria. So, for example, a change in the job applicant evaluation system can be driven by an effort to reduce its time and administrative costs or, on the contrary, by an effort to increase the quality of the decision to hire new employees.

Calculation of costs.

The specification of the main goals to be achieved on the basis of the planned investment or measure is followed by an analysis of the expected costs. To assess the effectiveness of the proposed measure, it is necessary to assess and compare not only the direct costs associated with the existing and the new process or system, but also their indirect costs.

Some of these costs can be estimated. The defined costs naturally include not only external expenses, but also the costs of internal company resources, both human and material. These are often underestimated, based on the argument that we "already have" these resources.

Examples quoted. An example of the hiring process improvements can be an effort to reduce the direct costs of this process by limiting or eliminating some activities connected with candidates the selection. Indirect costs of this process, on the other hand, can be reduced by decreasing the probability of a bad hiring decision.

Several HR managers stated that determining indirect costs requires attention to the broader implications of personnel decisions and requires some experience. However, it is definitely worth it. An example can be the experience of some companies showing that the departure of a senior manager brings indirect costs to the company in the range of 50-150% of his annual salary.

Evaluation of results (benefits).

The benefits of personnel programs or measures can take a number of forms: additional income, increased productivity or efficiency, increased work motivation, enhanced work skills, increased customer satisfaction, decreased work fatigue and erroneous actions, increased quality of decision-making, etc. For example, the added value of better evaluation of applicants for work may consist in higher performance of newly hired employees, higher flexibility of work teams, increased work motivation of other employees, etc.

As most HR managers emphasised, some of the expected benefits can be quantified directly, while others, which often have a more significant impact, may be more difficult to quantify. An example can be the decision to introduce a 360-degree assessment in order to increase the quality of information for individual development planning. In this case, the estimate of the expected benefits can be based on the results of pilot projects, or on the results of case studies. Similar to the costs, the analysis of the results, or the effectiveness of the new measure should be based on a comparison of the benefits of the existing and new system and their development over time.

Most managers interviewed admitted that evaluating the results of personnel investments or measures represents the most complex part of assessing their effectiveness. However, they stressed, it is absolutely necessary: every new personnel measure should be evaluated in a certain way, either to prevent ineffective programs or to reveal the causes of their ineffectiveness in time.

At the same time, the method of this evaluation should be determined before its implementation.

Determining the return on investment in human resources

Company managers striving to increase the effectiveness of their HR expenditures stressed that if it is possible to quantify the expected (net) revenues and costs of personnel measures, it is possible to determine the return (profitability) of investments in human resources by the ROI type indicator, i.e., returns on investment) and verify whether its value is positive.

Determination of risk factors and success factors

The aim of this step should be to determine the factors that influence the probability of success and failure of the proposed measures, for example factors that can delay the date of introduction of a new program, increase its costs, etc.

Among the factors that increase the probability of the proposed merger's success that stated the managers interviewed were, for example, that employees demand a similar measure, that the measure facilitates the work of both employees and managers, that it has influential supporters, or that similar measures have already been implemented in the past. On the other hand, risk factors may include the fact that managers or employees were not involved in the preparation of the measure in time, that the company does not have sufficient know-how for it, that the timetable for its introduction is not completely unrealistic, etc.

6 Conclusion

Answers to the research questions covering the issues whether the companies surveyed deliberately try to increase their human capital as a measure increasing the value of their intangible assets, if they deliberately try to increase their human capital, and, if yes, which means do they use for their HR capital formation, and if they strive, in an effort to build-up the HR capital, to evaluate and/or increase the effectiveness of their human resource investments and what methods – if any – do they use to raise their rentability, were the following ones:

- (i) most companies surveyed did not deliberately try to increase their human capital as a measure increasing the value of their intangible assets. Only 16% of the companies surveyed claimed that intangible assets are a matter of importance for them. Most companies (64%) did, however, according to their managers tried to increase their HR capital, the main reason for this being the increase of their productivity and rate of innovations. Some managers, expressed, however, a concern that an increase in HR capital of their employees could lead to an increase of their employees' turnover.
- (ii) unlike the components of HR capital stated in literature, most managers (79%) associated human capital with the capabilities, knowledge and expertise of the employees only. The rest of managers surveyed understood this notion as term including also employees' motivation and loyalty. Methods of HR management were not regarded as a component of HR capital. As the main means of HR capital formations (in 69% of the companies surveyed) were regarded various forms of HR training and development.
- (iii) only a minority of the managers/companies surveyed strived to take active steps to increase the effectiveness of HR investments. About one third on companies surveyed, however, did so, though most managers interviewed admitted that is usually much more difficult to enforce the analysis of costs, revenues and risks in the personnel area, mainly because traditional indicators of "results" or "efficiency" of personnel management measures have traditionally focused primarily on the list or scope of HR activities performed. As examples, indicators like the number of days needed to fill a vacancy or the number of people who have completed a certain training program (and not an indicator of the percentage of those who have completed the course successfully) were quoted.

Approximately one third of companies questioned, however, stated, they try to plan and subsequently evaluate the return on investment in human resources or newly implemented HR measures. HR managers of companies that take steps in this regard, stressed, however, that efforts in this area must be based on five basic steps. These steps include:

- clear determination of the goal or goals to be achieved on the basis of the planned investment or measure
- stating the planned and calculating the actual costs, both direct and indirect, initial (immediate) and ongoing, associated with the proposed measure and their comparison with existing costs
- determination, or subsequent assessment of the results/benefits of personnel investments and measures, both immediate and longer-term
- determination of indicators of return on investment in human resources
- determination of risk factors and success factors that can affect the expected expenses and benefits of the intended measures, and determination of ways in which these risk factors can be limited or neutralized.

The survey conducted did not find significant results' differences between companies of different industries or of different legal form. Further analysis should, however, in the future look at the issue of result differences of companies which are/are not quoted at the stock exchange.

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Primary Paper Section: A

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MANIFESTATIONS OF ANTI-SEMITISM IN PÁL ZÁVADA'S NOVEL PRIRODZENÉ SVETLO [NATURAL LIGHT]

¹ZUZANA VARGOVÁ

Faculty of Central European Studies, Constantine the Philosopher University, Institute of Languages and Culture of Central Europe, Dražovská 4, 949 01 Nitra, Slovakia
email: zvargova@ukf.sk

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Abstract: Our paper aims to examine how Anti-Semitism, its determinants, and its forms appear in Pál Závada's selected novel and, based on this analysis, to evaluate the extent to which its various forms are represented. The paper calls for more attention to the stereotypes and prejudices underlying various manifestations of intolerance.

Keywords: Anti-Semitism. P. Závada. Prirodzené svetlo [Natural Light]. Stereotypes.

1 Introduction

Central European history is marked by multicultural dialogue and the formation of various prejudices and manifestations of intolerance.¹ We could also include anti-Semitism, which can be generalised, albeit with considerable simplification, as an irrational, hateful attitude towards the Jewish ethnicity, its culture, and religion (Budil et al., 2013, p. 57), which is related to the perception of them as an alien, hostile, undesirable group (Bauman, 2003, p. 70). The concept of anti-Semitism is vague, linguistically imprecise in the sense of a negative attitude directed against the Jewish ethnic group. The Semitic ethnic groups include other ethnic groups (Arabs, Amharas). The term entered scholarly discourse at the end of the nineteenth century in Germany, during the period of European nationalism, to obscure the attacks against Jews (Danics - Kamín, 2008, p. 128; Nižňanský, 2016, p. 2).² Despite the objections above about the terminological designation of antagonistic attitudes towards Jews, we will apply this term in the context of this paper for two reasons: first, because it is a widespread and generally accepted term, and also because the attitudes referred to as anti-Semitic were explicitly directed against Jews.

According to the sociologist of Polish origin Z. Baumann, the Jewish ethnicity had the special status of "foreigners within" (2003, p. 71), who crossed "a vital border that should be clearly marked, untouched and impassable" (2003, p. 71). Hatred towards them has manifested itself in various forms throughout history. In addition to social conditions, the ideological motivation of the state's anti-Jewish policy, which sought to achieve the loyalty of the majority population to its own group/ethnicity by articulating otherness, incompatibility, or hostility towards Jews, was a determining factor in their emergence. Words were soon transformed into anti-Jewish practices, and "sick criminality" left a fatal trace in the history of European states. Even decades after the war, the collective consciousness/conscience is coming to terms with the aforementioned hateful mark by reflecting on the artistic representation of the period.

¹ Ján Gallik, in his study *Manifestations of Anti-Semitism as a Subject for Literary Satire*, also points to the current social discourse, in which "One can perceive several forms of hatred and aggression, which - not only on social networks - have been further accentuated by the global pandemic caused by the Covid-19 virus and, as if that were not enough, the long-accumulated hatred of Russia's political leaders towards Ukraine, but also towards the Baltic States, America and Central and Western Europe, has grown to horrific warlike proportions, the likes of which the European continent has not seen since the end of the Second World War. Once again, society is hearing about denazification. However, the term is being heavily used this time for Putin's propaganda and cited as the main reason for Russia's wartime invasion of Ukraine" (2022, p. 31).

² The adoption of the Jewish Emancipation Act (1861 in Baden, 1864 in Württemberg, 1871 in Bavaria) led, from 1878 onwards, to more pronounced manifestations of anti-Semitism; anti-Jewish political campaigns were organised and publications in a similar spirit were published (Wilhelm Marr: *Judentums über das Germanentum*, 1879; Eugen Karl Dühring: *Die Judenfrage als Frage der Racenschaedlichkeit*, 1881) (Vargová, 2011, p. 37). The German journalist W. Marr was the first to use the term anti-Semitism instead of the older term Judenhass (hatred of Jews) (Danics - Kamín, 2008, p. 128; Nižňanský, 2016, p. 2).

Art, and therefore literature, allows us to express what should not fall into oblivion, to capture anti-Jewish activities and anti-Semitic sentiments through the portrayal of Jewish characters and our relationship to them. Among these literary examples, we can also include P. Závada's novel *Natural Light*. However, the critical depiction of Jews is not precisely at the centre of the author's attention; it only enters the novel in connection with the representation of the horrors of the Second World War and situations of moral dilemmas. On the example of the work mentioned above, we will try to outline those forms of anti-Semitism that are assessed as the most influential/important in research on the causes and consequences of anti-Semitism in Central and Eastern Europe until the end of the Second World War.³ These are specifically anti-Judaism, racist anti-Semitism and anti-Semitism based on the stereotype of a Jewish world conspiracy.⁴

2 On the foundations of Závada's concept of the past

Pál Závada is one of those contemporary Hungarian authors whose work resonates with the events of the 20th century. They and the resulting trepidation, the sense of shame and guilt, as the author mentions, for example, in a round table discussion at the Slovak Institute in Budapest⁵ or in a documentary prepared by Czech Television⁶, become the creative impulse of his work to understand Hungarian and European history (Krause, 2021, p. 291). Historical events society perceives as traumatic need to be re-evaluated for social relations, peaceful coexistence between ethnic groups, and mutual understanding (Pál Závada, 2021, [online]). This reassessment is possible by opening up "new perspectives" on "sensitive and taboo topics", for example, by multiplying the perspectives of characters who "do not let history solidify into a grand narrative of collective memory, but work on it critically, constantly correcting it" (Görözdi, 2017, p. 434).

This understanding is determined by the informative/narrative value of the preserved documentary material but also by its confrontation and comparison. Assmann emphasises that "the group secures its identity" by remembering the past (2001, p. 50). Moreover, although the unreliability of memories is evident (affections and motives determine them, a person can get access only to a part of memories at any given moment), the "culture of remembering" (Assmann, 2001), based "on various forms of relation to the past" (Assmann, 2001, p. 33) and referring to a group, presupposes both "the observance of a social obligation" (Assmann, 2001, p. 31) and a resolution of what actually must not be forgotten (Assmann, 2001, p. 31). Assmann thus links memory to identity and the memory that underpins the community (Assmann, 2001, p. 32). A. Assmann makes a

³ On this, see the study *Antisemitismus-Definitionen und ihre Bedeutung für die Bekämpfung von antisemitischem Denken und die Verfolgung antisemitischer Straftaten* (2013, p. 10 – 11), a proceedings edited by B. Soukupová (2020).

⁴ Others include historicizing anti-Semitism and anti-Zionism. *Antisemitismus-Definitionen und ihre Bedeutung für die Bekämpfung von antisemitischem Denken und die Verfolgung antisemitischer Straftaten* (2013, p. 11).

⁵ "What selects or what controls (...) is the shame. That stirs my conscience and does not let me rest. So sometimes a person - whether guilty of it or not - suddenly comes across some problem, event, or a life history phase, which comes across some paper, document, I do not know what, and they are filled with shame. What is most embarrassing to dissect, what is most challenging to say, what I am least willing to admit about myself, my family, my village, my country, my blood, Hungarians and non-Hungarians, excites me. And, of course, the shame is somehow dissolved if you approach it in such a creative way, then you get a kind of work fever, and you feel something else." (translation by H.O.)

"Hogy mi szelektál, vagy mi vezérel (...) a szégyen. Ami nekem megindítja a lelkiismeretemet, és nem hagy nyugodni. Tehát olykor az ember -, ha vétkes benne, ha nem - egyszer csak találkozik valamilyen problémával, vagy valamilyen eseménnyel, vagy egy élettörténeti fázissal, ami találkozik valami papírral, dokumentummal, nem tudom mivel, és áthatja a szégyen. Ami legkínosabb boncolgatni, amit a legnehezebb elmondani, amit a legkevésbé szívesen vallok be magamról, családomról, falumról, hazámról, véreimről, magyarokról és nem magyarokról, az izgat. És persze a szégyen valahogy oldódik, ha ilyen kreatívan közelítünk hozzá, akkor valamiféle munkalát: kapja el az embert és akkor valami mást érez." (Németh, Z. et al., 2015, p. 58 – 59).

⁶ On this see Pál Závada (ČR, 2021, [online]).

similar point when she states, “We define ourselves through what we remember and forget collectively” (Assmann, 2018, p. 68). K. Jakubovská and V. Jakubovská also address the issue of remembering and forgetting in the context of individual and collective memory is also addressed by (2023, p. 33-52).⁷

P. Závada’s novel *Natural Light* supports these aspects: “[...] man, after all, is not an ox, which we can just walk from one pasture to another. And that, after all, it is not only their physical and mental personality, their name and craft that make one human, but also their environment, memories and past, acquaintances, friends, and even enemies. [...] Every written and unwritten relationship defines man, every connection and invisible pact, that is, everything that defines his life and personality [...]” (Závada, 2021, p. 52 – 53). The novel is an example of a literary elaboration – supplemented by black and white photographs – of the “traumatic experience” of the inhabitants of the village of T. in the years 1931-1947, but also a testimony to crimes, denial of one’s guilt or silence, while in the memoirs, Hungary’s responsibility in the Second World War and the “liquidation” of the Jewish population figure prominently in the memoirs.

The relationship to the past presented by Závada can be described in terms of M. Rothberg’s typology as “multidirectional memory”, in which memories of specific events do not suppress other events but, on the contrary, help them to form an effective remembering strategy (Kisantal, 2020, p. 47).

P. Závada uses the oral history method⁸, presenting the memories, recollections of witnesses and their interpretations of lived historical experiences. This remembrance is marked by reliving and longing to return to a particular place where they used to live and where they could find familiar things and people. The very first chapter expresses the relation to space in the description of the photograph: “*Standing in the sun-drenched Weisz studio around the wine barrel rolled in the middle, all of them testify at the same time that in us Slovaks – even in the inhabitants of T. – there can be a piece of true Hungarianism, especially if we have been strengthened not only by the truth of the restoration of the Upper Land, Ardiel or the Southern Land but also by the defensive force in the fight against Bolshevism... Most would not trade their fatherland for anything in the world ...*” (Závada, 2021, p. 11), but also in the introduction of one of the main characters, the narrator, Jan Semetka, who moved to Czechoslovakia with his daughter at the turn of the 1940s and 1950s, and who is visited by a delegation from his native village: “*Well, for whose sake was there a need to leave home? If only I could understand that! Once a person is at home where they are, how can they be convinced that they will be more at home elsewhere, blimey?!*” (Závada, 2021, p. 30).

At the same time, it is most remarkable that the fictional setting, whose characters stand at the centre of the narrative, is referred to only by the initials T., or, after Semetka’s relocation, it is the village of M. One can only assume that this is the author’s intention to express through referentiality/representation the disruption of the bond with space, forgetting and the disintegration of identity. Unlike the abbreviated village names of T. and M., the other geographical names and places in which the novel is set are identifiable (given in total), not only directly in the text but also through the historical maps shown on the book’s inside covers. The novel also alludes to the modification

of the political map of Europe, e.g. the annexation of northern Transylvania to Hungary.

Although the novel presents the individual coping of the narrators/“remembering subjects/witnesses” with the past, it is evident that it is a “collective” effort to grasp the past, to rescue it from oblivion, to revive it and to re-evaluate it (Hodrová, 2006, p. 378). The novel’s peculiarity is the abundance of multiple narrative voices. “The ‘re-construction of memories’, the various stories of “present” characters/narrators, is carried out by Závada through – as he calls it – “our” and “your narrator” (Závada, 2021, p. 505). It is reminiscent of Bakhtin’s polyphonic novel, in which every experience or thought of the narrator is intrinsically dialogic and polemically coloured, yet it is a “replica” of an unfinished conversation (Bakhtin, 1973, p. 241). Through the realised interviews and testimonies of the characters – equal narrative voices – Závada allows observing and glimpsing into the transformations of a person’s inner life and the social reality that the work “uncovers”.

At the same time, the very title of the novel indicates the reception of the work as a “penetration” into a little-known space, i.e. overcoming the silence about certain “indelible traces”, events that we do not like to confront. According to S. Kraus (2021), the adjective in the title and the symbolism of light are essential, referring to the objectivity of the view of history, the plausibility and testimonial capacity of the interviews, letters and photographs. However, in recollection, the narrator himself draws attention to the process of creating the fictional text: “*One simply interconnects the cracks in their memory – whether they are from childhood or a later period – and constantly wants to stitch them back together, always trying to cover up the empty spaces with false patches*” (Závada, 2021, p. 394).

2.1 Anti-Judaism

Anti-Judaism, or religiously motivated anti-Semitism, considered the oldest form of anti-Semitism, finds the cause of the Jews’ “negative morals” and all misfortunes in the Jewish religion and the Talmud. It can be seen as negative attitudes towards the way of life and behaviour of Jews, which are determined by religious rules and regulations on diet and cleanliness (Danics – Kamín, 2008, p. 130). C. Iacu also gives concrete examples in this connection namely works such as *The Jew, Judaism and Judaization* by Gougenot des Mousseaux and *Jewish France* by Édouard Drumont, which draw attention to the dangers due to the “infiltration” of society by Jews and the “Judaization” of Christian Europe, or France.

The aspect of confessional difference is present marginally and differently in Závada’s work, depending on the different parts of the novel.

In the pre-war period, the coexistence of ethnic groups in terms of “religious identity” did not appear to be problematic. The Jews are an integral part of T.’s community, and religious distinctions with the rest of the population are illuminated minimally, briefly mentioning the characters’ religious affiliations. The fact that they are “inverts” is conveyed to us by one of the narrators – Mária Semetková, for example, in a letter addressed to her friend: “*After all, almost all of my friends play in the girls’ evangelical mandolin orchestra – except for Juci Weisz, who is deaf as a doornail and is Jewish, and also for our community piano artist Anna Ágoston, who is a pianist. ... You know, my Bözsika, ever since the Slovak theatre group performed the play *A tót menyecske*, that is, *The Slovak Bride*, the official copy of which was obtained by the honourable lady, and we have been frequent guests at subsequent rehearsals - with or without the mandolin, as musicians, singing dancers, and even as actresses. [...] Nevertheless, a few boys also got on stage in the same meandering way I did – more out of social requirement than out of a desire to stand on stage. Such as the painter’s assistant Bandi Ackermann, who paints the props, but is also an extra, although he has no singing voice and, as an Israeli, he*

⁷ In the article *Culture of Reminiscence as a Part of Cultural Education*, they write, “Our individual memory relies on the collective memory of the group of people to which we belong (family, school, interest groups). Every one of us forms individual memory during our socialisation. Although collective memory derives its permanence and strength from a whole group of individuals, only individuals are the ones who remember. Collective memory differs from individual memory in that collective consciousness cannot be explained merely based on knowledge about the individual psyche because the society that creates it greatly exceeds human individual capabilities” (Jakubovská, K. – Jakubovská V., 2023, p. 33-52).

⁸ The oral history method of recalling destructive events related to the Holocaust is used in his work, for example, by P. Vilikovsky. More about it see Antoňová, 2022, p. 37-43.

does not even speak Slovak” (Závada, 2021, p. 38 – 39). The above excerpt documents that the narrator communicates the religious identity of the characters in a neutral “mode” when describing events or when portraying the characters – residents of the village of T., although, in their early days, even the members of the Hungarian political parties did not see the limited practice of religion as problematic. P. Závada refers to the March Front movement and its press organ, the magazine *Válasz* (Answer – Z.V.’s note), in order to draw attention to the strengthening of the ruling policy and the “Fascization” of Hungarian society by reflecting on the “rhetoric” of the members of the March Front movement: “*And if it comes to the point that those as mentioned earlier (the Jewish population - Z.V.’s note) get their hands not on weapons, but on work tools, let our youth take it with the understanding that in their spare time, they are always coming together to practice their faith, and then we will not snatch their holy scriptures out of their hands for no reason*” (Závada 2021, p. 84). Although it is only one of the “Hungarian political groupings”, his choice is intentional in order to signal fundamental changes in Hungarian social life: the adoption of a new press law in 1938 and a law limiting the representation of the Jewish population in the state and public administration in 1938 (Bata, 1974, p. 956 – 957; Vargová, 2011, p. 53 – 54). The change in the political climate thus influenced the position of the Jewish ethnic group in Hungary in 1938. Despite the anti-Jewish legislation⁹, however, it took some time for the mobilising potential of ideas activating hatred and anti-Jewish ethnicity to result in open violence. However, changing the religious beliefs of the Jewish ethnic group was not the goal of the growing influence of Germany and its Nazi regime. Religion was applied only as a distinctive marker to differentiate a Christian from a Jew.

However, the phenomena of religious life are present in the novel to show the difference between the Jews themselves, some of whom already had more liberal attitudes towards religious (dietary) habits. The Ackermann family still represents “conservative” Judaism: “*It is good that she (Éva Koleszár - Z.V.’s note) no longer thinks of Bandi Ackermann, his father at that time was portioning and measuring kosher meat and from time immemorial he observed all religious principles – including the fact that he could ride in a wagon with his son for a ritual bath as far as the Mures River*” (Závada, 2021, p. 120). Religious affiliation in the first part, unlike the second, does not become a kind of stigma. However “*it is the observance of the rules of kashrut that separates the Jew from their social surroundings and prevents them from assimilating... It should be noted, however, that kashrut did not and does not mean social isolation, because Jews everywhere, wherever they are accepted and respected, strive for the well-being of the country, and they have friends among non-Jews as well*” (Slivka et al., 2013, p. 70).

Antagonistic attitudes towards the Jewish population only escalated due to the German occupation of Hungary. The second part of the novel consists of István Semetka’s memories of the Eastern Front and the battles of the Hungarian army alongside Nazi Germany. The memoirs confront us not only with the relationship to the Jewish labour servants, given over to the “will or ill-will” of Hungarian officers [*“One unexpected memory comes to the surface: on the way here, while handing out lunches to the labour servants, I slapped a Jew for insolent back talk”* (Závada, 2021, p. 155)], but also to Hungary’s participation in the liquidation of the Jewish population. There is no shortage of detailed and naturalistic descriptions of the physical liquidation of the “Transcarpathian Jewish community” (Závada, 2021, p. 201), or mention of this human ruthlessness and cruelty recorded through photographs: “*Two pictures show people being forced to undress at the head of a large snaking mass, another shows the naked victims in groups of ten, one group standing on the left, a second group in the middle just approaching the pit,*

and a third group on the right being ordered to lie down on top of the naked corpses lying in the half-full pit. In the fourth picture, lying people are being shot in the back of their head, and in the fifth, you can see a close-up of a pit with corpses and that some are still raising their heads or hands. [...] I wondered what if the eyewitnesses would tell all this one day” (Závada, 2021, p. 174).

Belonging to Judaism is revealed through an insinuation of the typical Jewish man’s appearance with payot. Payots or sideburns are characteristic primarily of Orthodox Jews. Their wearing is based on the Third Book of Moses and “*symbolises the edges of the fields at harvest time, which, according to tradition, were not reaped so that widows, orphans and strangers could gather the remains of the produce. Cutting off the payots meant turning away from orthodox dogmas and the will to assimilate with the outside world*” (Hradská – Molnárová, 2006, p. 119). The basic tenets of the Jewish religion also underpin a strong sense of togetherness and unity for survival.

Along with the image of the Jew – a devotee of Judaism – the presence of religiously motivated anti-Semitism is also identifiable in the novel’s second part. We can speak of four forms of it here.

In the first case, it is the image of the Jew as a morally inferior “element”, causing not only general indignation by his behaviour but also violating the religious rules established by the Old Testament. Thus, for example, in the novel, we are confronted with the image of the violation of eating habits¹⁰, the prohibition against eating meat from a horse and carcasses: “*[...] and this here is a frozen horse, the soldiers and Jews used to go to it for days, pick it, gnaw on it and sometimes when they had just managed to build a fire, they cooked a piece of it*” (Závada, 2021, p. 262). An image/contrast is thus formed between the Jew and the moral man.

The second form is the ridiculing of the Jews for their religious customs, specifically the covenant of circumcision, which originated in God’s covenant with Abraham.¹¹ P. Závada here draws attention, among other things, to the cruelty and practices by which the Hungarian soldiers did not lag behind the German officers. “*In the second case, only the Hungarian Raven unit was present. Near the lake at the edge of the village, they dragged about a dozen naked Jewish men, supposedly partisans, up into the trees with fallen crowns. However, the two corporals were not satisfied with this; they stripped the corpses of their genitals, cut the skin on the lower abdomen on two sides and – as if in jest – put their hands ‘in their pockets’*” (Závada, 2021, p. 172).

The narrator presents the third one through the emphasised confessional affiliation of the majority and their antagonistic attitudes in the gathering and transfer of Jews to the ghettos: “*When fellow Christian citizens rushed to the streets and in the language of the commandants started shouting, Jews out, deploy quickly, one-two and so on, logically it was supposed to speed up the whole process, but it was the other way around, these unnecessary spiteful remarks, shouting and rushing somewhat disrupted the smooth course of the evacuation*” (Závada, 2021, p. 377).

However, the fact of setting fire to Jewish synagogues as symbols of Jewish faith and culture, as well as the indifference of the inhabitants to their rescue, cannot be overlooked either. “*[...] one night, at the beginning of October, when the arrival of the Russians – [...] – was only a few days away, a fire broke out in the centre of Sarvaš. [...] It was a synagogue that burned to the ground; only ruins remained; many watched, but the firefighters did not come, and no one even moved to put out the fire. [...] After all, their domination, which persecuted us and evicted us from our homes, will finally come to an end; the moment is approaching when they will have to come out with*

⁹ The first anti-Jewish law in Europe was adopted in Hungary (it restricted the admission of Jewish students to universities as early as 1920). However, it may be noted that it was the Hungarian Jews who were the most closely aligned with the majority nation (Vargová, 2011, 53).

¹⁰ See Holy Bible, 2002, Leviticus 11: 1-47

¹¹ On this see Holy Bible, 2002, Genesis 17: 9-13.

colour and say where that many people have disappeared, but instead of bitterly regretting it, instead of being at least additionally horrified at what they have done, [...] at the last moment they will still burn down the synagogue. Moreover, in Sarvas, it hardly bothers anyone anymore. Who should be concerned? They shrug because there are no Jews in Sarvas anymore” (Závada, 2021, p. 487).

Anti-Semitism concerning religious traditions and customs in the post-war years remains outside the author’s attention in the last part of the novel, perhaps because “those who were classified as Jews could no longer return home, and those who could also prefer to go away” (Závada, 2021, p. 525).

2.2 Racist anti-Semitism

Although anti-Semitism initially had a religious character, it gradually took on the character of racial discrimination, which the Nazis used as an instrument of mobilisation. They could transform the concrete Jew into an abstract Jew and, against negative connotations, perceived them as a socio-political problem that had to be solved. They were inspired by the works of authors who defined the racial characteristics of Jews, such as R. Knox (*The Races of Men*, 1850), J. A. Gobineau (*Essai sur l'inégalité des races humaines/Essay On The Inequality Of Human Races*, 1853-1855), or drew attention to the fateful encounter and struggle of the Aryans with the Jews, such as E. Drumont (*La France juive*, 1886; *La France juive devant l'opinion*, 1886; *Le Testament d'un antisémite*, 1891) and H. S. Chamberlain (*Die Grundlagen des neunzehnten Jahrhunderts*, 1899).¹²

In a situation where confessional segregation was gradually losing its justification¹³ in terms of Jewish identification, the racial discourse was used to emphasise the superiority of the Aryan race and the danger of degeneration due to the mixing of races, and thus the racist justification of the need for anti-Jewish measures. The racial overtone was not decisive for the novel’s antagonistic attitudes towards the Jewish population. Instead, it was a deliberate conflation of ethnic and racial differences. We assume that the reason for this lies in the fact that in the interwar period, the feeling of Hungarian ethnic awareness¹⁴ was dominant among Jews, and the process of cultural assimilation to which P. Závada refers is also traceable: “And I will be honest, my Klárka, Margó continues, the most incomprehensible thing for me is that my parents from Nagyvárad and I have long since freed ourselves from the outdated Jewish rules, not to mention Dezső, who is a complete atheist, and yet they consider us to be the same Jews as those who go around bearded in a kaftan or a wig and observe all the religious rules, I do not understand this, I do not understand why” (2021, p. 353). Unlike religiously motivated anti-Semitism, Jews, according to the racist idea, could never get rid of their “Jewishness”; it was given by their origin, appearance, and clothing, determined by faith and government regulations.

In Hungary, the “Race Protection Act” defined “Jews” more broadly than the Nuremberg Laws (Iacu, 2014, p. 149), which inadvertently gives the impression that “the Hungarians were more ruthless than the Germans themselves” (Závada, 2021, p. 405). Despite the primacy of the legislative anchoring of discrimination¹⁵ motivated by anti-Semitism, the “reality of everyday life” was different. As Paul Lendvai, an Austrian journalist of Jewish descent born in Budapest, notes, “Despite Jewish laws, nowhere in Central and Eastern Europe could more than 800,000 Jews (including converts) have lived as long and in such relative safety as in Hungary at that time,” (2002, p. 336), although, on the other hand, “Nowhere in Central and Eastern Europe, however, were Jews so quickly and so brutally

sent to their deaths as in Hungary” (Lendvai, 2002, p. 405). In his novel, Závada indirectly and casually encourages us to reflect on the “reality of the war years” and the relationship of the majority to the Jewish population in the individual Central European states with notes as if on the margin, the narrator’s little significant “inputs” from the point of view of plot development, or employing the characters’ speeches. The following passage is an example of this: “Will they (occupiers - note Z.V.) observe any of the civilized standards? Personal property, personal freedom, expertise, Christian faith and morals, culture and in general, basic human contact, honesty or decency? And what behaviour is recommended if there is no satisfactory answer to these doubts? There is no guaranteed recipe, my dears, from now on one can behave as one pleases, and most often the unpredictable adversity of fate decides here” (Závada, 2021, p. 461).

Anti-Semitism became an ideological tool that could very quickly unite against the “supposed evil” and demand that Hungarian youth - as the novel also captures - “love their breed even more than they hate Jewry” (Závada, 2021, p. 84).

However, these are rare instances where the novel refers to antagonistic attitudes based on racially connoted discourse. We assume that anti-Jewish sentiments were primarily conditioned by the political situation in the country, which appears to be “the land of the Jews” (Závada, 2021, p. 641).

2.3 Anti-Semitism based on the stereotype of a Jewish world conspiracy

P. Závada “revives” several negative Jewish hetero stereotypes in the novel, including the stereotype of Judeo-Bolshevism as a complot of world Jewry (Slivka et al., 2013, p. 193). The Jews’ adherence to communism and membership in communist organisations was conditioned by the idea of a social system guaranteeing equality for all people. This very circumstance was perceived as a threat in the 1930s, and Jews were accused of trying to take over the world. This stereotype enters the novel through an ironically tinged conversation between Jakab Weisz and Matyi Koleszár: “Listen, Kóbi, pokes Koleszár under Jakab Weisz’s rib while we are waiting for the bus to Makó, the guys here say you are a Marxist. [...] He has not read a line from the person in question, but why couldn’t he be a Marxist? [...] And when asked whether this Marxmania is any characteristic racial trait among them, he replies that, of course, it shows up clearly in the examination of the foreskin and the blood; it is now even an organic part of the Talmud. [...] Jakab knows very well that this Marx is just an ordinary, well-built backstabber and, in our way, a horrible, unpleasant Jew. [...] Well, Mr Weisz, I am not looking forward to it. You’d better give everyone the same respect, please, whether someone is a stinking Jew or not” (Závada, 2021, p. 79). Závada reinforces the stereotype of the Jew as a communist/socialist citizen here with the attribute of the stinking man as the originator of many problems/diseases of the individual and society, but also as a parasite.

The image of the smelly Jew is anchored in multiple dimensions. It also refers to the inhumane treatment of Jews during the transports to the extermination camps, their “cramming” into freight cars without the possibility of personal hygiene. “We assume that Jakab, who tries to board an overcrowded carriage to his parents in Csaba, is pushed away with a stick by the policeman, to whom Erna will later approach with a plea in Debrecen. She said she saw her son on the train that had just arrived, so she begged the commander nicely to be so good as to allow her to meet him so they could exchange at least a few words. [...] Erna is allowed to approach the carriage Jakab is in, she is allowed to shout at him, and soon he appears in the deflected doorway. [...] The policeman commands, “Forward and march”; when only five steps separate Jakab and Erna, the command “Stop standing, stinking Jew” is heard. And the filthy bastard gets orders to take his pants off. Did he go deaf? Pants. And if he needs to be petitioned to take his shitty pants off. Or maybe they should have some Jewish whore brought in. And then Jakab Weisz is ordered to grab his circumcised dick. Jakab

¹² See Budil et al., 2013, p. 227-229.

¹³ This categorization faded as Jews converted to save themselves from deportation.

¹⁴ As a result of this ethnic identification, some Hungarian historians consider, such as Gy. Ránki, the tragedy of the Jewish population is also the tragedy of the Hungarians (Lendvai, 2002, p. 337).

¹⁵ As a result, for Jews, including the “fictional Juci Weisz,” for example, “a teaching career becomes only a longed-for dream” (Závada, 2021, p. 279).

clutches his penis in his palm, and the policeman immediately hits him with a wooden club, after which Jakab falls to the ground; Erna jumps up to him with a scream, she manages to touch her son, but two armed men immediately drag the prisoner away, and he, while he is being pushed into the carriage, shouts, it is okay, mom, do not worry, nothing is wrong, mom" (Závada, 2021, p. 398). In this realistic depiction, Závada confronts us with a devastating dishonesty of human existence, making the inhumanity of the conditions visible, referring to the rhetoric of the time and the portrayal of Judaism as a contagious disease or "parasites of civilisation".

3 Conclusion

The innovativeness of Závada's novel lies in the author's creative inventiveness in underlining the tragedy of human destiny, the amorality of actions, including the absurdity of racial, ethnic and cultural intolerance. With its "multivocality", the novel provides a "truer" – albeit not unambiguous – account of a world that can find justification for amoral actions, of a survival strategy, but also of the meaning of human being anchored not only in "cultural constraint" but also in moral "endowment". Závada's novel captures the destructive nature of the historical violence caused by anti-Semitism, revealing its extent in the population and the prevalence of the religious level of anti-Semitism in close connection with other forms of anti-Semitism. P. Závada does not name the culprits of the (Central) European cataclysm of unprecedented scale: "But why do they lie to us so much? Why did we have to come here, and for whom did so many people die? Who are the perpetrators? We, commanders, who, according to the German Major General Brinzei, were sparing the blood of conscripts? We, with the lowest rank, who suffered together with the foot soldiers (...) Is that why we are Azazels, fallen angels?" (Závada, 2021, p. 518 – 519). The novel portrays the pre-war and war years from 1931 to 1947 not only as a tragedy for Jews but also for other participants and passive witnesses, i.e. all those who were somehow affected by the war events.

Looking back at the "panorama of history" does not mean simply learning from the "milestones of history", but - referring to Z. Bauman - "the control of the past enables the control of the future", and in the name of this future it is "necessary that those who are in control of the present do not allow the past to be manipulated so that the future becomes inhospitable and uninhabitable for humanity" (Bauman, 2003, p. 330).

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SECONDARY SCHOOL MATURITA READING LISTS AS A MOTIVATION TO SUPPORT READING

^aDANA VICHERKOVÁ, ^bNELA NOVÁKOVÁ,
^cVERONIKA MURINOVÁ

University of Ostrava, Faculty of Education, Department of Education and Adult Education, Fráni Šrámka 3, Czech Republic

email: ^adana.vicherkova@osu.cz, ^bp22048@student.osu.cz, ^cmurinova.v@email.cz

The paper was created with the financial support of the SGS project at the Faculty of Education of the University of Ostrava. The authors thank for the support provided to SGS12/PDF/2023 Factors influencing the understanding of (e)non-artistic texts among students at secondary vocational schools with a technical orientation in the Moravian-Silesian and Olomouc regions.

Abstract: Reading motivation is incredibly important for both formal and informal lifelong learning. According to research studies such as PISA (2018) (Programme for International Student Assessment), PIRLS (2021) (Progress in International Reading Literacy Study), educating active readers is a key priority. A study was conducted using the content analysis method of documents "School Maturita reading lists" to determine the actual content of the current school reading lists of artistic texts in the reality of technically oriented secondary schools in the Moravian-Silesian and Olomouc regions of the Czech Republic. In addition, the researchers aimed to discover what kinds of non-cognitive aspects influence reading among students at technical secondary schools using the method of semi-structured interviews with 12 students. One of the most exciting findings of this research was that more than half (75%) of respondents believed that motivational reading recommendations from parents, family spending free time reading, and awareness of the value of reading for life were among the solid non-cognitive factors influencing their interest in reading, the joy of talking about what they have read, experience sharing. External and internal factors can shape pupils' attitudes and motivation to read. The majority (90%) of the respondents considered school Maturita reading lists a formal study obligation.

Keywords: reading motivation, reader education, secondary school Maturita reading lists, cognitive and non-cognitive aspects of reading, reading research

1 Introduction

The Czech School Inspectorate (ČŠI) conducts national-level testing of primary school students' reading skills and competencies in the Czech Republic. The PIRLS (2021) research offers an international perspective on ten-year-old readers' reading abilities, attitudes, and cognitive and non-cognitive aspects. Meanwhile, the PISA (2018) research focuses on the quality of reading abilities, reading culture, and social aspects of reading among fifteen-year-old readers.

Children's motivation to read develops formally and informally during their early (pre-school), primary, and secondary education. It is a need that develops as part of lifelong learning. Various factors can influence the development of reading skills across different reading ages. These include the availability of reading support in the school environment, such as libraries, reading clubs, reading excursions, author readings, reading portfolios, and school reading lists. Reading motivation is closely related to activating a person's targeted behaviour.

2 Motivation and Education of the Reader

According to Homolová (2008), the pubescent age can be seen as a crucial point for readers. Kassin (2007, p. 407) defines motivation as an internal drive that motivates individuals towards a particular goal. Plháková (2023, p. 395) describes motivation as the summary of all intrapsychic dynamic forces or motives, which organise behaviour and experience to change unsatisfactory situations or achieve positive outcomes. Homolová (2008) focuses on the pubescent age, which significantly changes personality, interests, and orientations towards reading. Reading interest, competence, and need decrease during this period, and individuals choose romantic stories with a central hero they can perceive as a role model. The reading needs of both sexes also change. Pubescents view reading as an escape from reality and a way to spend their free time. Reading is closely linked to a basic human need for activity and dynamic personality traits like temperament, character, or will (Homolová, 2008, pp. 26-28).

As part of the research "Reading in the system of pubescent values and norms" (Homolová, 2008), dealing with the issues of the influence of reading on personality development, types of motivation leading to higher reading intensity or the amount of reading from the perspective of pupils and teachers, showed that pupils perceive the influence of reading on personality development as less important than teachers. Pupils consider the amount of reading a trivial factor for lifelong reading. An important finding is that pupils are primarily emotionally motivated to read, but teachers do not reflect this motivation (Homolová, 2008, pp. 95 - 103). Motivation by classic authors and artistically valuable literature is falling due to pupils' predominantly emotional motivation to read, and it is necessary to focus on this issue (Homolová, 2008, p. 113). The author (2013) also dealt with the problem of adolescent reading with an emphasis on the significance of the adolescent stage of the process of developing an individual's relationship with a book, as in this period, there is a shift in a different interest and individual focus concerning independent learning for the next phase of secondary school and university studies. Students at this age no longer read to unravel the plot but also perceive the composition of sentences, the text's structure, or the vocabulary's richness. The fundamental difference between the perception of reading by adults and teenagers is in the position of reading within the reference groups. Adolescents frequently do not report reading. On the contrary, adults perceive it as a positive thing within general standards. However, adolescents need much more motivation to read than a child or adults. Reading provides new experiences and educates. (Homolová, 2013, p. 267-269). Readership research was also conducted by Trávníček (2007, 2010 in Homolová, 2013, p. 272-273), who focused on adolescent visits to public libraries and reading fiction and reading in a digital environment. The research findings were that 86% of adolescents are readers (however, the debatable criterion for the concept of the role of "reader" was reading at least one book per year). Also, 50% are passionate readers (the criterion for evaluating the role of a "passionate reader" was reading at least 50 books per year). Another result of the research was that interest in reading increases with the reader's age. From a research perspective on the digital reading environment, it emerged that the Internet does not significantly compete with books and, on the contrary, supports the sale of books.

2.1 Reading and reading attitudes

According to Ernst Pöppel (in Garbe, 2008, p. 10-11), reading is a natural activity of the brain that involves various components, such as cognitive (thinking about the content of reading and expanding one's knowledge), affective (feeling and appreciating the experience of reading), and conative (maintaining a regular or irregular reading habit). Toman (2009, p. 52) defines reading attitude as an individual's connection with reading, which may vary according to their level of reading intensity. Homolová (2013, p. 171) explores whether reading frequency affects one's reading attitude and interest. Helšusová (2012) considers a reader to read at least 1-2 times a week.

3 The Current Concept of the School Maturita List of Artistic Reading in the Czech Republic

Significant changes were made to the Maturita examination in the Czech language from 2020 to 2022. The oral exam now has a profile character, and each secondary school that administers the Maturita exam has specific rules for organising it while adhering to the Ministry of Education's requirements, effective January 1, 2022. The oral exam is conducted as a structured interview using a worksheet containing excerpts from a literary work. Each secondary school that administers the Maturita exam provides a mandatory list of reading materials to students in their fourth year of study. The Catalogue of Examination Requirements of the Common Part of the Maturita Examination (Cermat, 2019/2020) served as the starting point for compiling the

Maturita reading lists, which includes genres of works, types of works, selected Czech and world literary works, and exact numbers of literary works for secondary school reading. The Catalogue's basic rules for creating the School Reading List (2019-2020) included:

1. "The minimum number of offered literary works is 60. The upper limit is not set.
2. A comprehensive work, not a part of it, is considered a literary work.
3. The edition is specified for a literary work from world literature.
4. The student submits a list of 20 literary works based on the criteria for selecting Maturita reading for the oral part of the examination to the head teacher" (Catalogue, 2019/2020).

Literary works, including prose, poetry, and drama, should be part of the School Maturita reading list. Furthermore, the School list contains a maximum of two works by one author. Pupils create Pupil reading lists from the School Maturita reading lists.

4 Research Methodology 1

As part of the Student Grant Competition project (SGS, 2023), we surveyed the Faculty of Education of the University of Ostrava from January to March 2023. The aim of the research was to address the issue of motivation to read among students at secondary technical schools in two regions of the Czech Republic. A total of 12 respondents were selected for the research, five from a technical secondary school in the Moravian-Silesian Region and seven from a secondary school in the same region. The research adopted a semi-structured interview method to explore the non-cognitive factors influencing reading among students at technical secondary schools.

The interview was divided into three categories, containing 18 closed and semi-open items. The three categories were: A Motivation to read (reading experiences, needs, communication about what has been read), B School list of secondary school reading, and C Reading activities, behaviour, and attitudes. We evaluated the qualitative research data using the method of coding and categorising data according to approach (Švafíček & Šedřová, 2014).

Research results

A Area: motivation to read, reading experiences and needs, communication about what has been read:

- respondents commented in A1 whether they like to read for pleasure and have a personal relationship with literary texts. Half, i.e., six (50%) respondents, answered positively (yes, I read artistic texts for pleasure). On the contrary, another 6 (50%) respondents stated that they do not read for pleasure and do not have a personal relationship with literary texts. Respondents' answers to the question of a qualitative nature (explain why you do not like reading literary texts) were categorised into three areas: 1. lack of interest in reading a literary text (examples of answers: literary texts are boring, I'm not interested in poems, I don't enjoy novels), 2. misunderstanding of the literary text (examples of answers: the literary text is difficult, I don't understand the prose, artistic texts are difficult, I'm bored, I don't read them to the end, I often don't understand them), 3. preference of other activities for pleasure (examples of the answers: I do sport instead of reading, reading slows me down, I'd rather fish, I can only read for a while, it's a waste of time).
- question (A2), whether the pupils discuss the book they read, was positively answered only by three respondents (yes, I discuss the book I read), and nine replied (no, do not discuss a book I read). From the respondents' qualitative answers, why they discuss/don't discuss the artistic text, it is clear that half of the respondents did not answer the given question (the respondents did not justify the problem). The answers of the other 6 (50%) respondents

were categorised into two areas: 1. I don't have anyone to discuss this reading with/don't want to discuss it (examples of answers: "I don't know anyone to tell anything about the short story I've read", "no one is interested in what I'm reading, I don't tell it"), 2. I discuss what I have read with friends, parents, classmates, and the teacher ("I often tell my friend what I read, we mainly enjoy historical prose, battles", "I talk at home with my parents about what everyone often reads during the holidays", "I must regularly tell the teacher which fiction I read", "we talk about what we read with our classmates").

- question (A3), whether pupils have a reading pattern that motivates them to read artistic texts, was answered negatively by 9 (75%) respondents (no, I do not have a reading pattern for reading artistic texts). Only 3 (25%) respondents answered affirmatively (yes, I have a reading pattern for reading artistic texts). From the qualitatively oriented answers of only 3 (25%) respondents to the question of how a reading role model motivates them to read artistic reading, it is clear that one respondent stated that "the father is a passionate reader of everything, what can be read, mostly fantasy stories, for which we both draw pictures of monsters". From other respondents' statements about their motivators (models) for reading artistic texts, it is clear that they influence the intensity of their emotional experiences, which is evident from the statements of 2 respondents: "When reading war novels, my father sometimes shouts, other times he lowers his voice, that also attracts me to read", "my friend often cries at sad stories."

B Area: School Maturita reading list

- respondents commented in B1 whether: a) they consider School Lists of Maturita Reading as a school obligation or b) they consider School Lists of Maturita Reading as motivation for reading. An alarming finding is that 10 (83.33%) respondents consider them a school obligation, and only 2 (16.66%) consider them a motivation to read. Three categories were determined from a total of 10 qualitatively oriented answers to the question of why they consider School Lists of Maturita Reading as a school obligation: 1. SL as an unnecessary (formal) study tool for reading (examples of answers: "the list does not offer me what I enjoy reading, there are formal titles", "often outdated book titles", "I don't need a list, the school hasn't changed it for more than 20 years"), 2. SL as a demotivating factor to study ("lists keep me from reading, which I enjoy", "books in the lists bore me", "I don't read reading lists, I read texts that I enjoy, that have meaning in life"), 3. SL as a manipulative way to reading and studying ("lists are a scarecrow to reading anything, they just order something", "I consider the lists as persuading the school to read by force", "the lists do not allow the free choice of books to read for students", "the lists take away our freedom to study by reading").
- respondents expressed their opinion in B2 whether students can cooperate in creating SL. 12 (100%) respondents answered negatively (no, I cannot participate in creating the SL). From the qualitative answers of the respondents, why would students like to be involved in the creation of the proposal of the SL, we categorised 3 areas: 1. deeper interest of students in recommended reading by the school (examples of answers: "I like to read, so I have a general overview of quality literature, what would I also recommend to students read", "I enjoy reading, I would like to help with what to read for school"), 2. students' motivation to create a more modern secondary school ("the lists are quite inflexible, I would include more modern literature", "the list could be formally more innovative in terms of content and with digital references to artistic texts"), 3. interest in cooperating with teachers in the creation of secondary schools ("I would like to help the teachers if they wanted", "there is no offer for cooperation in the construction of the list by the teachers, they think that we don't understand, I would like to help", "they say we are not educated in this literary and didactic field, but I would be involved").

- respondents commented in B3 whether they understood the information in SL. 6 (50%) respondents answered the question positively (yes, I understand the information in SL), and 6 (50%) respondents answered negatively (no, I do not understand the information in SL). In the case of a negative answer, the respondents had the option to specify what they did not understand, but none of them used it. The respondents could not specify what information they did not understand regarding the SL content.

C Area: Reading activities, behaviour, and attitudes

- the respondents commented in C1 whether they consider reading artistic texts valuable for life. Half, i.e., 6 (50%) of the respondents, answered positively (yes, I consider reading artistic texts a life value). On the contrary, another 6 (50%) respondents said they do not consider reading artistic texts a life value. Respondents' answers to the question of a qualitative nature (justify why you consider reading artistic texts to be valuable for life) were categorised into three areas: 1. reflection of the wisdom of our ancestors, tradition (examples of answers: "My grandmother has already told me about some stories and poems", "He who reads a lot knows a lot, for example, my grandfather", "I can find what I don't understand in a storybook"), 2. Relationship to art (examples of answers: "I like to draw and pictures are in books, that's valuable", "after all the word is art") 3. Connection with life (examples of answers: "in the Bible, there is a connection with life", "what happens around us in life is captured by stories").
- respondents commented in C2 whether they spend their time reading in the family. Only 4 (33.33%) respondents answered positively (yes, we spend our free time reading in our family). A total of 8 (66.66%) respondents answered that they do not spend their free time in the family reading. 0 (0%) respondents answered the qualitatively oriented question to specify how the family spends their free time reading.
- respondents commented in C3 whether they read more than three books in 1 school year. Only 3 (25%) respondents answered positively that they read more than three books in 1 school year. Nine respondents (75%) said they read at most three books in 1 school year. Based on coding, we categorised respondents' answers to a question of a qualitative nature (why you read more than three books a year) into two areas: 1. reading for fun (examples of answers: "I read a lot, I enjoy it", "I read for pleasure, to it brought fun, joy, satisfaction", "I enjoy reading nice books", "I read what my brother also enjoys" 2. reading for knowledge (I choose to read what I am interested in, what I want to know more about", "I read, to be smarter than father").

An attractive research discovery reveals that 75% of those surveyed were influenced by non-cognitive factors, such as parents providing motivational reading recommendations, spending free time reading with family, and understanding the value of reading in life. These factors contribute to their interest in reading, the pleasure of discussing what they've read, and sharing with other readers. The research clearly shows that both external and internal factors play a role in shaping students' attitudes and motivation towards reading. Furthermore, 60% of those surveyed consider the school Maturita reading lists a formal study obligation.

5 Research Methodology 2

Between December 2022 and March 2023, the second phase of our research focused on analysing the school Maturita reading lists from ten technical secondary schools in the Czech Republic. We began with a qualitative research approach to develop our research plan and tool for analysing the content of the reading lists at the selected schools (Vicherková et al., 2020). Our research objective was to determine the types of literary texts in the reading lists of schools completed by the Maturita examination in the Moravian-Silesian and Olomouc regions

using a content analysis method. Using document analysis, we analysed ten school reading lists from 10 technical secondary schools in these regions. The first phase of our research was also conducted between December 2022 and March 2023.

Our research aimed to analyse the reading lists of artistic texts in secondary schools focused on technical education in the Moravian-Silesian and Olomouc Regions of the Czech Republic. By conducting a content analysis of the school Maturita documents, we determined whether the current school reading lists align with the guidelines outlined in the Catalogue of Requirements (CERMAT, 2019/20) for graduation.

5.1 Content analysis of school Maturita reading lists (artistic literature)

5.1.1 Objectives of content analysis and research questions

Main objective

The research objective is to analyse the content of the school Maturita reading lists of 10 secondary technical schools completed by the Maturita examination in the Czech Republic.

Partial objectives

- To find out how many works of contemporary Czech literature of the 21st century (published since 2000) are represented in selected school Maturita reading lists.
- To find out how many works of contemporary world literature of the 21st century (published since 2000) are represented in selected school Maturita reading lists.
- To find out how many world and Czech literature works up to the end of the 18th century are represented in selected school Maturita reading lists.
- To determine how many world and Czech literature works up to the end of the 19th century are represented in selected school Maturita reading lists.
- To find out whether there is a difference in the number of books in individual selected school Maturita reading lists of selected secondary technical schools.
- To determine how many printed publications are represented in selected school Maturita reading lists.
- To determine how many electronic publications are represented in selected school Maturita reading lists.
- To find out whether the number of printed publications prevails over electronic ones in selected school Maturita reading lists.

Research questions related to sub-objectives 1-7:

- Are works of world and Czech literature up to the end of the 18th century represented in the selected school Maturita lists in a minimum number of 2 literary works (according to the requirements set out in the Catalogue of Examination Requirements for the Common Part of the Maturita Examination (Cermat, 2019/2020)?
- Are works of world and Czech literature up to the end of the 19th century represented in the selected school Maturita lists in a minimum number of 3 literary works (according to the requirements set out in the Catalogue of Examination Requirements for the Common Part of the Maturita Examination (Cermat, 2019/2020)?
- Are works of world literature of the 20th and 21st centuries represented in the selected school Maturita lists in a minimum number of 4 literary works (according to the requirements set by the Catalogue of Examination Requirements of the Common Part of the Maturita Examination (Cermat, 2019/2020)?
- Are works of Czech literature of the 20th and 21st centuries represented in the selected school Maturita lists in a minimum number of 5 literary works (according to the requirements set out in the Catalogue of Examination Requirements for the Common Part of the Maturita Examination (Cermat, 2019/2020)?
- Research questions related to sub-objective 5:
 - Do the selected Maturita lists contain more works than the specified minimum number according to the Catalogue, 2019/2020 (i.e., 60 works)?

expressed that the SL is an unnecessary (formal) study tool for reading because "the list does not offer me what I enjoy reading, there are formal titles", "often outdated book titles", "I don't need the list, the school doesn't change it any more than 20 years". Furthermore, it is clear from the results of the research that the respondents consider SL:

- as a demotivating factor to study ("lists keep me from reading that I enjoy", the offer of books in the lists bores me", "I don't read reading lists, I read, texts that I enjoy, that have meaning in life"),
- as a manipulative way to read and study ("lists are a scarecrow to read anything, they just order something", lists = convincing the school to read by force", lists do not allow free choice of books to read for students").

Furthermore, the respondents commented in C1 whether they consider reading artistic texts valuable for life. Half, i.e. 50% of the respondents, answered positively (yes, I consider reading artistic texts a life value). On the contrary, another 50% of respondents said they do not consider reading artistic texts a life value. Alarming information is (C3) that only 25% reads more than three books in 1 school year. Bloom (2000) considers the canon a grouping of works based on their aesthetic value. Horáková (2021) and Králíková (2020) dealt with the research analysis of the school list of literary works.

It is clear from the results of the second phase of the research that the content analysis of the documents pointed to the problem that P1 contains works of world and Czech literature up to the end of the 18th century in the specified minimum number of 2 literary works in only eight reading lists. Two Maturita reading lists from ten schools (20%) offered only works of world literature up to the end of the 18th century; Czech literature up to the end of the 18th century was not part of the list. P5 (the norm of 60 literary works) differs in the actual number of literary works listed in the reading lists of 10 schools. The number of recommended literary works in the lists ranged from 62 to 147 publications. There are no titles of literary works in electronic text in the Maturita reading lists (0%). No link to an electronic publication was found on the schools' websites in any analysed school art reading lists from the ten technical secondary schools.

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THE DIFFERENCE BETWEEN PROJECT PRICES AND FINAL PRICES OF CONSTRUCTION CONTRACTS IN THE PUBLIC SECTOR

^aJAROMÍR VRBKA, ^bEVA KOUBKOVÁ

*Institute of Technology and Business in České Budějovice,
School of Valuation and Expertness, Okružní 517/10, České
Budějovice 37001, Czech Republic
email: ^avrbka@mail.vstecb.cz, ^bkoubkova@mail.vstecb.cz*

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Abstract: The paper deals with the difference between project and final prices of construction contracts in the public sector. The project price of construction contracts is usually created using price systems, while the final prices of contracts are based on the actual interest of construction companies in the implementation of a given contract, actual cost, and the state of the market for construction works and materials. The paper presents an analysis of a total of 1,021 construction contracts awarded by the public sector in the Czech Republic in 2019-2020. These contracts are divided according to the predominant nature of the work into three categories, namely demolition, reconstruction, and construction. The authors conclude that the project and final prices of construction contracts differ, both in terms of regional destination and the nature of the subject of the contract (construction, demolition, etc.). The biggest savings were found in contracts dealing with demolition work, where secondary income can be expected in the form of sales of secondary raw materials. Moderate savings are also achieved in the case of contracts concerning reconstruction or construction.

Keywords: construction industry, project prices, final prices, public sector

1 Introduction

The construction industry is an integral part of the economy, as it creates and manages long-term fixed assets, and enables achieving profit in other sectors of the economy. The construction industry thus creates and adjusts the material basis for all other sectors of the economy. Even the tertiary sector could not function without the construction industry, as it would lack establishments, infrastructure, etc. Therefore, it is quite logical that the construction industry is a fundamental element of all economies in the world. Even the most advanced economies in the world have a developed construction industry, which is reflected in the materials and technologies used, as well as in the maintenance of already constructed buildings.

Customers of the construction sector can be divided into two basic groups, the first group includes commercial/private customers from companies, and the second group consists of public contractors (government institutions).

Project price is an amount determined based on project documentation and cost estimates for a given construction project. The project price includes the cost of materials, labor, technical equipment, administrative fees, and other related costs. It is usually set before the start of the construction process and serves as a starting point for evaluating and comparing offers from potential suppliers.

A public sector construction contract's final price is the actual amount paid for a completed construction project. It is the result of competition and negotiations with contractors, where costs may change based on various factors, such as changes in the scope of work, unforeseen construction problems, inflation, additional requirements, or construction risks. Vrbka et al., (2020) deal with comparing the concepts of equilibrium price and market price.

Several factors can contribute to the change between the project and the final price of construction contracts in the public sector. These factors include:

- 1) Changes to the scope of work - changes that may occur during construction can increase or decrease costs. This may be due to the requirements of investors, changes in legislation, or unexpected problems that require modifications to the project.

- 2) Additional requirements – requirements occurring during construction that were not originally included in the project documentation. These requirements may affect the total cost and may lead to a change in the final price.
- 3) Inflation and price changes - prices of materials, labor, and other costs may change over time due to inflation, market fluctuations, or economic factors. These changes may affect the final price of the construction contract.
- 4) Construction risks – construction projects are often subject to various risks such as technical problems, delays, unforeseen events, etc. These risks can have an impact on costs and can result in changes in the final price. It is important for public institutions and construction contractors to carefully monitor the difference between the project price and the final price. Transparency, effective communication, and careful monitoring of costs are key factors in managing construction projects and minimizing unwanted differences between expected and actual costs.

Selecting appropriate systems for managing public infrastructure construction project is a major challenge for governments. The existing literature provides an extensive theoretical background for the analysis of different public-private governance regimes for the provision of public infrastructure services; however, little has been said about the innovation incentives of specific contract forms and their welfare implications under different governance regimes (Dhanshyam et al 2021).

2 Literary research

In a public-private project construction projects combine both construction and management tasks, whereas, in traditional public procurement, they are delegated to individual private contractors. These two modes of service providers differ in terms of their incentives to innovate and gather private information about future costs to adapt the provision of services to changing situations. The mode preferred by the government depends on the cost of gathering information, the cost of innovation efforts, and the degree to which the efforts are contractible (Hoppe & Schmitz, 2018). Interesting findings are presented by Krulický & Vochozka (2021), who developed a method for the valuation of real estate and its consequences.

In their research, Čermáková & Hromada (2022) deal with the comparison of the prices of development projects across territories, when at the end of their work they proposed suitable paths for sustainable development, while Research conducted by Virglerová et al., (2022) focus on risk at SME markets.

In the case of complex public procurement projects, it is difficult to draw up enforceable contracts, where the interest in the lowest possible price often clashes with the interest in the highest possible quality of work. Failure of a contractor to meet their obligations poses an acute risk, especially in the case of intense competition for the contract. A well-established incentive mechanism used to mitigate the problem of contractor default is to withhold a payment, where the contracting authority postpones payment of part of the final price for the construction work until other requirements are met (e.g., expiry of the period of trouble-free operation of the works, etc.). Upon completion of the project, the buyer shall determine the amount of the retainage to be released to the seller, taking into account any possible defects. Although this is generally a feasible form of a contract to be implemented, the practical difficulties in assessing completion represent a moral hazard for the buyer (Fugger et al., 2019).

Horák et al., (2020) proposed a new approach for evaluating companies applicable in the case of construction companies executing contracts for the public sector.

In the context of recent initiatives to increase the transparency of public procurement, the authors focus on the effects of disclosing information about previous public procurements in an environment where an organization delegates its purchasing decisions to its employees. If employees can exercise discretion in selecting a supplier, which may be influenced by personal preferences, employee incentives may be misdirected toward the organization.

When implementing complex public procurement projects, it is often not possible to draw up complete contracts. As a result, the customer-supplier relationship is important for the success of the project. A poor relationship can result in reduced trust on the side of the customer during the sourcing process and increased opportunistic behavior on the side of the supplier after the purchase. We consider an environment where the winning supplier decides on the level of quality to be provided to the customer and compare a standard reverse auction and a customer-specified reverse auction.

Hromada (2021) addresses the issue of housing affordability in the Czech Republic, especially about socioeconomic indicators. Current trends in consumer behavior are analyzed by Dusek (2020).

The relationship between customers and suppliers is often given by factors that go beyond the terms of a contractual agreement. Customers can thus benefit from the identification of trusted suppliers. The authors claim that suppliers' pre-contractual actions, such as making higher customer-specific investments without any long-term contract, can indicate the trustworthiness of suppliers (Beer et al 2018).

Another view on real estate is provided by Krulický & Horák (2019). In their research, they focused on real estate as an investment asset. Hromada & Krulický (2021) modify investment in real estate and added socioeconomic factors to the evaluation.

In a competitive bidding process, the success and/or failure of suppliers depends to a large extent on the submitted bid price. The decision on the bid price is thus a strategic issue for construction project contractors. Some parameters of the model, such as the number of competitors and the cost of the project, are estimated by analyzing historical data. Next, a mathematical model is developed to determine a bid price that maximizes the expected profit. To reduce the risk of a large loss, a maximum acceptable risk constraint is used in the model (Rastegar et al., 2021).

Determining the bid price is a key issue for contractors and construction companies. Contractors' performance in competitive bidding directly depends on their bidding strategy (Rastegar et al., 2020).

To win a project contract through competitive bidding, contractors shall submit a bid price determined by a markup on the estimated project costs. The success of the bid thus depends largely on the accuracy of the estimate, which means that the estimation process needs to be allocated sufficient funds (Takano et al., 2018).

The bidding process for construction and infrastructure is highly competitive and complex, which entails various uncertainties contractors must face. Multi-stage bidding (MSG) is even more complex. In this process, general contractors need to handle the complexities of accounting for their subcontractors' bids and face "a greater threat of falling prey to the winner's curse" (i.e., a situation where the winning contractor underestimates the actual project cost) (Ahmed & Adway 2022).

With the huge increase in spending on public projects, contractors shall use effective and efficient bidding strategies to cope with the competitive bidding environment. General contractors usually perform part of the work and subcontract the other parts to submit a comprehensive joint bid. This bidding arrangement is referred to as multi-stage bidding, where

subcontractors submit their bids/offers to the general contractor, who, in turn, submits a final joint bid for the entire project. In a multi-stage bidding environment, general contractors may face an increased likelihood of lower or even negative profits. Despite previous research efforts aimed at developing bidding models, there is a need to address the issue of the multi-stage bidding environment, hereafter referred to as the multi-stage game, in the professional literature (Ahmed et al., 2022).

In the construction sector, contractors face many uncertainties during their projects, such as cost overruns, project schedule delays, and safety issues. To overcome such complications, contractors apply different risk management approaches that reflect their risk behavior and attitude towards expected risks, as well as bidding decisions. Risk attitudes are influenced by a variety of factors, including personal characteristics, or demographic, social, and cultural influences. The results of the survey conducted by Awwad & El Irani (2022) show that the major factors are the completeness of project information and the need for contractor work.

In large projects, project segmentation and planning the size of construction bids' contract packages is a complex and critical issue. Due to the nature of construction projects, for which large budgets, long durations, and many activities with complex procedures are typical, project segmentation requires complex decision-making. The owner can determine the bid price behavior of contractors in response to different sizes of work packages. The optimal segmentation solution from simulated scenarios is chosen using a multi-attribute decision-making method (Shiue et al., 2021).

To help manufacturers adequately hedge against the risks of input commodity price fluctuations, indices based on the price-to-contract ratio are used, based on which manufacturers can transfer part of their risk to downstream retailers and implement risk sharing in the supply chain. A two-stage Stackelberg game showing that the hedge ratio is positively related to consumer preference for green products, but inversely related to green product R&D costs is used. Interestingly, in the supply chain of a competing producer, the profits of both producers grow significantly when the input commodity price fluctuates slightly; however, when the fluctuation continues to increase, the profit of one producer decreases while the profit of the other grows slowly. From a different perspective, green degree competition negatively affects the profits of both manufacturers and retailers and decreases the green degree (Wang 2022).

A contractor's ability to prepare a competitive bid for a construction tender is essential for their survival in the market. The bid price and estimating strategy should enhance the probability of winning from a sufficient number of bids, but at the same time ensure the economic stability and development of the company. The Czech construction market is generally perceived as a low-cost-oriented market with a relatively frequent occurrence of abnormally low bids (Hanák et al., 2021).

The requirement for efficient use of public funds leads contracting authorities to use electronic reverse auctions (e-RA), a tool enabling financial savings to be achieved (Hanák et al., 2018).

Recommending bidders' identity of bidders in public procurement auctions (tenders) affects considerably many areas of public procurement; however, it has not been studied in detail. A bidder recommender could be a very beneficial tool, as the supplier (firm) can search for suitable bids, and on the other hand, the public procurement contractor can automatically discover unknown firms suitable for a given bid (Rodriguez et al 2020).

Performance management is one of the key managerial activities (Hanák & Marović 2022).

Manta et al., (2022) point to the need to capitalize all components of sustainability. There is a need to introduce a

sustainability clause when awarding contracts. To clarify this question, countries report to the World Bank. To map this issue, the opinions of other researchers are systematized and relevant studies of international organizations (OECD, European Commission, UNESCO, World Bank) are also considered (Manta et al., 2022).

From the perspective of gaining a competitive advantage, building a positive reputation, e.g., using modern digital marketing tools, is also crucial in all sectors of the economy (Partlova et al., 2022, Sagapova et al., 2022).

Under European law, public procurement procedures are strictly regulated to ensure equality of bidders and high quality of goods and services (Plaček et al., 2020).

Vrbka et al., (2020a) focus on determining the increase in market price of real estate resulting from reconstruction. The authors deal with this issue in more detail in their other publication (Vrbka et al., 2020b).

3 Materials and Methods

Long-term monitoring of the construction market was carried out: The data for the analysis contains information on 1130 construction contracts awarded by the public sector in the Czech Republic in 2019-2020, with the completion in 2021-2022. This is based on the relatively long duration of construction works and the efforts of the authors to always take into account the final price of the construction contract, known only after its completion.

The data was drawn from publicly available sources, as municipalities and cities are required to publish data on public contracts by Act No. 134/2016 Coll., on Public Procurement. In most cases, municipalities and cities publish information about their plans and concluded contracts on their websites, or they are available for inspection by municipal or city office staff. Prices will be given in Czech crowns excluding VAT.

For each construction contract, the database provides the identification of the contracting authority (city, municipality, governmental institution), the identification of the construction contract, the original project price of the contract, and the final price of the construction contract. All construction contracts will be into categories by their nature as follows:

- Construction
- Reconstruction/construction modifications of an already completed work.
- Demolition

Construction contracts will subsequently be divided according to the territorial aspect of their implementation by the NUTS2 nomenclature.

The first step will be to check the completeness of the data to verify whether the data for construction contracts is complete, in particular the information about the final price of the construction contract due to its non-completion or non-disclosure before the end of the construction market monitoring. These construction contracts will be excluded from further analysis.

The next step will be to determine the basic characteristics of the dataset, both in absolute and relative terms. Furthermore, the average prices per construction contract in each category will be determined.

Next, a regression analysis will be used to determine the relationship between the project and the final price of construction contracts.

4 Results

The initial dataset contained data on 1,130 construction contracts awarded by public institutions in the Czech Republic in 2019-2020. After checking the completeness of the data, data on 949 construction contracts was subject to further analyses, which means that 181 construction contracts started in 2019-2020 and their final cost was not considered.

The following table shows the number of construction contracts classified by their type and region of implementation.

Tab. 1 Overview of the number of construction contracts by type and region

Region	Demolition	Reconstruction	Construction	Total sum
City of Prague	0	99	50	149
South Bohemian region	3	36	19	58
South-Moravian region	1	92	32	125
Karlovy Vary Region	0	10	4	14
Hradec Kralove region	4	33	23	60
Liberec region	2	22	9	33
Moravian-Silesian Region	3	64	31	98
Olomouc region	3	54	27	84
Pardubice region	0	32	21	53
Pilsen Region	1	33	14	48
Central Bohemian Region	3	76	38	117
Usti Region	1	30	14	45
Highlands	0	19	13	32
Zlín Region	1	22	10	33
In total	22	622	305	949

Source: Authors.

As can be seen from the previous table, most construction contracts were implemented in the "Reconstruction" category in the city of Prague. This is apparently since in the territory of The City of Prague, there is the largest number of buildings owned by the government sector; at the same time, this region is generally considered the most creditworthy.

The following table shows the average project price in the studied regions.

Tab. 2 Average project price of construction contracts (in thousands of CZK)

Region	Demolition	Reconstruction	Construction
City of Prague	0	50,008	191,775
South Bohemian region	22,366	20,135	32,546
South-Moravian region	41,000	41,446	42,776
Karlovy Vary Region	0	18,793	13,570
Hradec Kralove region	93,265	40,372	53,209
Liberec region	19,765	45,661	10,480
Moravian-Silesian Region	44,738	30,906	31,101
Olomouc region	26,968	32,275	41,128
Pardubice region	0	36,813	60,531
Pilsen Region	400,000	70,684	144,474
Central Bohemian Region	51,901	30,101	42,272
Usti Region	97,776	23,307	62,113
Vysočina region	0	40,163	63,236
Zlín Region	15,760	28,148	25,827

Source: Authors.

The table above shows the average project price of an average construction contract in individual regions. The highest average demolition price was recorded in the Pilsen Region, but this was only one significant construction event; therefore, the value cannot be considered relevant. The highest average construction price was recorded in the City of Prague and again in the Pilsen region.

Table 3 below shows the average final price of a construction contract.

Tab. 3 Average final price of construction contracts (in thousands of CZK)

Region	Demolition	Reconstruction	Construction
City of Prague	0	52 288	192 055
South Bohemian region	11 366	16 914	32 475
South-Moravian region	40 000	35 376	42 237
Karlovy Vary Region	0	18 838	11 324
Hradec Kralove region	87 652	38 534	43 574
Liberec region	15 101	43 945	8 980
Moravian-Silesian Region	38 670	28 727	28 322
Olomouc region	25 339	30 120	44 238
Pardubice region	0	35 401	55 335
Pilsen Region	346 739	74 623	149 942
Central Bohemian Region	41 370	28 009	36 406
Usti Region	84 821	21 110	66 292
Vysočina region	0	37 946	57 868
Zlín Region	12 236	25 201	20 884

Source: Authors.

Table 3 presents an overview of the average final price of construction contracts in the monitored regions. Based on the presented data, the highest final price of construction contracts was recorded for construction contracts - construction in the City of Prague.

Table 4 shows the relative difference between the project and the final price of construction contracts.

Tab. 4 The relative difference between the project and the final price of construction contracts

Region	Demolition	Reconstruction	Construction
City of Prague	x	+5 %	+/- 0 %
South Bohemian region	-49 %	-16 %	+/-0 %
South-Moravian region	-2 %	-15 %	-1 %
Karlovy Vary Region	x	+/- 0 %	-17 %
Hradec Kralove region	-6 %	-5 %	-18 %
Liberec region	-24 %	-4 %	-14 %
Moravian-Silesian Region	-14 %	-7 %	-9 %
Olomouc region	-6 %	-7 %	+8 %
Pardubice region	x	-4 %	-9 %
Pilsen Region	-13 %	+6 %	+4 %
Central Bohemian Region	-20 %	-7 %	-14 %
Usti Region	-13 %	-9 %	+7 %
Vysočina region	x	-6 %	-8 %
Zlín Region	-22 %	-10 %	-19 %

Source: Authors.

It follows from the table that the biggest difference was recorded in the case of demolition contracts when the difference represented a saving compared to the project price. This can be explained by achieving secondary income from demolition (sale of secondary materials, ...). The table also shows that there was usually a reduction in the final price compared to the original project price. This may be due to the competitive struggle between construction companies and the construction project prices based on general price lists for construction works, i.e., without considering the possible savings and the profit policy of the individual company.

4.1 Difference between project and final prices depending on the project price.

Table 5 below shows the determined correlation coefficient between the project price and the achieved difference in final prices for individual orders. It can be assumed that in the case of large construction contracts, economies of scale are reflected, and therefore for a contract with a higher project price that does not consider economies of scale, these potential savings will be reflected in an overall lower final price for the work.

Tab. 5 Correlation of the difference between the project price and the final price

	Demolition	Reconstruction	Construction
Number of contracts	22	622	305
Correlation	0.22817	-0.01372	0.02017

Source: Authors.

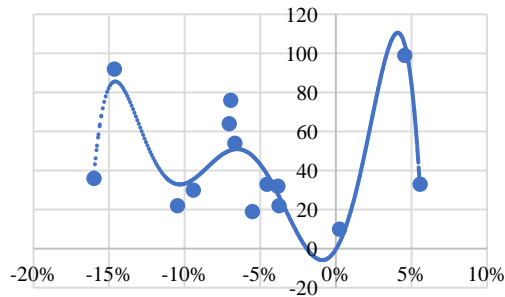
As can be seen from the table above, the correlation coefficient reaches relatively low values. It is thus not possible to confirm the mutual dependence and determine the final price based on the original project price of the construction contracts. A relatively stronger correlation was only observed in the case of construction contracts in the category "demolition".

4.2 Difference between project and final prices depending on the number of contracts by region.

Below, the relationship between the project and the final price of construction contracts will be analyzed in the "construction", "reconstruction", and "demolition" categories depending on the number of contracts processed in individual regions. At this point, it can be assumed that the higher the number of construction contracts in the region, the higher the demand is directed to the construction companies, which can allow them to increase the bid price.

The following figure graphically illustrates the project and final price ratio and the number of construction contracts in the "reconstruction" category in individual regions of the Czech Republic.

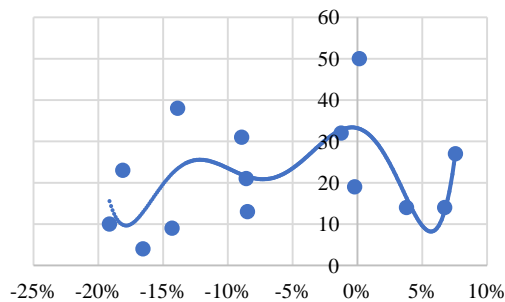
Figure 1 The relationship between the project and final price and the number of "reconstruction" contracts in the regions



Source: Authors.

The following figure graphically shows the project and final price ratio and the number of construction contracts in the "construction" category in individual regions of the Czech Republic.

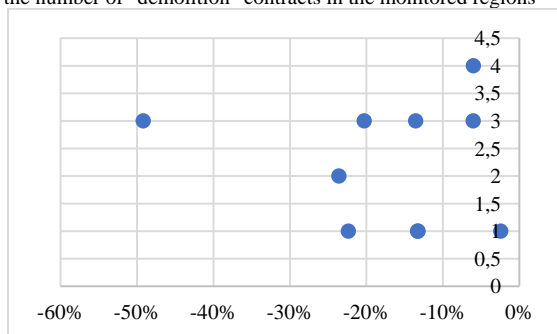
Figure 2 The relationship between the project and final price and the number of "construction" contracts in the regions



Source: Authors.

The following figure graphically shows the project and final price ratio and the number of construction contracts in the "demolition" category in individual regions of the Czech Republic.

Figure 3 The relationship between the project and final price and the number of "demolition" contracts in the monitored regions



Source: Authors.

Based on the presented analyses, it can be concluded that the difference in the final price compared to the original project price (savings or price increase) is not influenced by the number of contracts processed in a given region.

5 Discussion

The processed data confirmed the fact that the final price of construction works is usually lower than the original project price. About the significant statistical set of researched works (949 construction contracts) awarded by public institutions in the Czech Republic between 2019-2020 and subsequently completed, it can be concluded that public institutions have

economically rational expectations when awarding construction contracts, which makes it possible to achieve savings in most cases compared to the original project price. The largest savings are achieved in the case of "demolition" construction contracts, where it is possible to expect the use of secondary raw materials by construction companies. In this regard, construction companies seem to count on secondary income and are thus willing to execute demolition contracts well below the project price.

The difference between the project price and the final price is also due to the different methodologies of their determination, as project prices are determined based on the price list of construction works, which is the basic general guide for drawing up itemized budgets. However, specific final prices also reflect the specifics of individual buildings and the pricing (profit) policy of construction companies.

6 Conclusion

The goal of the paper was to determine a possible difference between the original project and the final prices of works in awarding public construction contracts by public institutions in the Czech Republic. The original project prices are made public by the institutions at the time of announcing public contracts as "expected prices". Construction companies can then apply for tenders and offer a price for which they would implement the given construction contract. Based on their judgment, construction companies can offer a price higher or lower than the original project price. The authors analyzed 949 construction contracts awarded by public institutions in the Czech Republic in 2019-2020 and subsequently complemented until 2022. These contracts were divided by their nature into the "demolition", "reconstruction" and "construction" categories. The research results show that in most cases, the final price of the construction contract is lower than the original project price, which means that public contracting authorities usually achieve savings. The analysis of the data shows that there are no differences in terms of the amount or number of contracts or the region in which the contract is executed.

Further research could focus on monitoring contracts awarded in the next years, i.e., from 2021 on, and monitoring the final prices. Considering the long-term horizon between the award of the contract and the knowledge of the final price for work in the order of years, the authors would suggest repeating this study approx. in 2 years, e.g., in 2024.

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Primary Paper Section: A

Secondary Paper Section: AH, AP

SUPPORT FOR PARENTS WHEN EDUCATING PUPILS DURING DISTANCE EDUCATION IN THE TIME OF THE PANDEMIC

^aJOZEF ZENTKO, ^bPETER TOKOŠ, ^cROMAN HRMO

^a*Katolícka univerzita v Ružomberku, Hrabovská cesta 1A, 034 01 Ružomberok, e-mail: jozef.zentko@ku.sk,*

^{b,c}*Department of Didactics of Specialized Subjects, DTI University, Sládkovičova 533/20, 018 41 Dubnica nad Váhom, e-mail: ^btokos@dti.sk, ^chrmo@dti.sk*

The contribution is a partial output of grant task VEGA No. 1/0550/22 Current status, trends and problems in technical education at the lower and upper secondary level of the school, in the context of distance learning (2022 - 2024).

Abstract: The authors of the paper present research findings focused on the role of parents when supporting their own children during distance education (ERE). It is part of a problematic and one of the research tasks addressed in VEGA project No. 1/0550/22. The aforementioned starting points, as well as the discourse of foreign researches, led the authors of the paper to study the opinions and experiences of parents and their help and support when educating pupils during distance education in the time of the COVID 19 pandemic. The paper presents only one part of a large-scale research study with a package of research and statistical methods (analyses, on-line questionnaires, structured individual interviews, the method of Focus Groups, quasi-experiments, the SPSS program package version 2.0) and more. A total of 407 parents participated in the presented part of the research. The research results show that the parents of lower secondary education (ISCED 2) students [AM 2.1] and the parents of upper secondary education (ISCED 3) students [AM 2.3] were not entirely satisfied with the overall course of distance education (ERE) and its organisation.

Keywords: distance education- Emergency Remote Education (ERE), the parents of students, lower secondary education (ISCED 2), upper secondary education (ISCED 3), quality of education, technical education

1 Introduction and theoretical background

The problematic of technical education, implemented face-to-face or in a distance form, is very broad. Is addressed by many leading experts at home and abroad Kožuchová, (1993); Pavelka, (1996); Honzíkova (2015); Huľová - Šukolová (2017); Kožuchová - Huľová (2020), Huľová, 2021; Depešová (2008); Hašková - Lukáčová (2022) ; Agaton - Cueto (2021); Davis (2021); Lau - Lee (2021); Sonnenschein, S. - Grossman, E. - Grossman, J. (2021) and others.

Due to the COVID-19 pandemic, a distance education (Emergency Remote Education (ERE) has also become dominant in Slovakia, since March 2020. This organisational form retained its status during the 2020/2021 school year and partly also in the 2021/2022 school year, in which hybrid education (is education that was introduced during the pandemic as a combination of distance education from home (ERE) and face-to-face education at school) dominated. According to Huľová - Kožuchová (2021), several educational problems arose in connection with a change in the organisational form of education, which had to be immediately dealt with. The problems were not only related to insufficient ICT equipment, but also to limited experience in working with communication and attendance software as well as to the methods of education.

Teaching methods and organisational forms of education were adapted to distance education. The endeavour of each teacher was to teach as efficiently as possible, to increase the quality of the educational process, to motivate students, and to ensure the all-round development of their personality; especially during the distance education (ERE), which experienced an unprecedented boom as a result of the pandemic. The sudden and completely unexpected transition from face-to-face teaching to distance education meant not only changes in the approach of educators and the students, but also the parents of these students.

The technical education we have investigated was also implemented through distance education. It includes both theoretical and professional education, as well as an inseparable practical preparation of the individual for a future occupation. According to Huľová (2019) a well-prepared students should be creative, technically minded and able to use certain tools and technical equipment, master technologies and programs, and fully apply creativity, not only in life, but especially in his or her

future profession. Professions with a technical focus are important in many areas of human society, therefore systematic institutional training must be ensured for the pupils, which is part of a school education both here and abroad (Brečka - Valentová, 2018). Distance education, despite many obstacles, can be implemented effectively, provided that all participants approach this form of education responsibly.

In addition to the students and teachers, the parents also became a part of distance education, many times against their will. The role and workload of the parent, during the process of distance education (ERE), corresponded to the age of the child and the grade he or she was attending. Without a doubt, the parents are an important and irreplaceable part of the upbringing and educational process. Their role became even more important during the transition of schools to a distance form education, due to the global COVID-19 pandemic. Not all parents accepted this fact with enthusiasm, and not all of them identified with their new role. Despite this, parents helped and supported their own children to the best of their ability during this difficult educational period.

2 Background of the research study

This difficult pandemic period for everyone involved was a stimulus for scientists, who carried out a lot of research focused on distance education.

From research, which was carried out in many countries around the world, we have obtained relevant information about the course of distance education, about technical, physical or psychological problems on the part of the students and teachers, but also the parents of the students who, even if they did not want to be, were an important part of distance education. Bokayev (2021), implemented research focused on the satisfaction of the parents of students with regards to the course of distance education. The results of the study showed that the age and income of the parents were positively correlated to their satisfaction with distance education. Davis (2021) examined the link between distance learning and the mental health of the parents, who were inadvertently forced into taking on the role of the teacher due to the pandemic situation. The results of the study showed that parents with students who struggled with distance education, experienced increased symptoms of anxiety and depression. Güvercin - Ayse - Sait (2021) investigated the views of parents on distance education. From the results of the research, it emerged that distance education is understood rather as a means of support, to face-to-face education at school. Drawbacks mentioned by the respondents included administrative problems, insufficient infrastructure, and the fact that distance education does not provide equal opportunities for the education of all students. Abuhammad (2020) investigated barriers to distance education, from the perspective of the parents, and through social networks and keywords, has purposefully identified local groups whose discussion was content-oriented on distance education and the parents. The aim of the study was to describe and clarify how parents perceive obstacles and barriers to distance learning for their children during the corona virus outbreak. An analysis of 248 posts showed that parents encountered several obstacles, from personal to technical, logistical and financial. Parents most often mentioned personal problems, especially a lack of professional training and support, and a lack of communication and qualifications in the area of distance educational. Technical barriers were also identified. Distance education (ERE) was hampered by insufficient investment, maintenance and connectivity. Problems also arose from the point of view of logistics when introducing distance learning. Parents also cited financial problems, because the purchase of the necessary technology, and the costs associated with online education, led to financial problems for many families. Apriyanti (2020) investigated the role of parents in supervising their students

distance education. An unstable internet connection turned out to be one of the problems. Several schools sent the students online assignments. As the author describes, the parents gave the task to the students, they solved it, and the parents sent the results to the teacher. The WhatsApp platform was used as a communication channel due to its ease of use, low operating costs, availability and immediacy. So parents had to wait for assignments from teachers every morning. The author states that it was a monotonous activity, and the students were bored with the everyday method of such teaching; they did not have an exciting learning experience. Some students did their schoolwork without parental supervision. It was mainly with families, in which there were several siblings, and the parents could not devote all the time individually to just one child. The research results presented many shortcomings and obstacles, which appeared during distance education. The students did not want to learn, they could not concentrate on learning within the home environment. The reason was also due to disturbances in the home, as well as poor support, supervision and checking by some of the parents.

Sonnenschein, S. - Grossman, E. - Grossman, J. (2021) notes, that COVID-19 has caused increased stress amongst adults as well. Many parents were worried about whether they would be able to help their children with distance education due to school closures. In the presented study, which was carried out, the types of activities parents carried out with their children during distance education were investigated, whether these activities differed according to the age of the students, and whether there was a connection between engaging in various activities and being stressed. The results of the study show that most parents have engaged with their children in education monitoring activities or in supporting learning through technology. Although these activities varied according to the students' age, parents who reported participation in distance education activities also reported increased stress. According to Agaton - Cueto (2021), parents faced various challenges in the area of online education. They struggled with the insufficient availability of the necessary technology, financial difficulties, unsatisfactory educational results, and personal problems related to health and stress. Huřová (2021) also reported that families did not have adapted and modified conditions for learning in the home environment, and thus students experienced rapid fatigue, nausea or stress.

According to Milushkina - Popov - Skoblina - Markelova - Sokolova (2020), the transition to distance education in the spring of 2020, led to the excessive use of information and communication technologies by participants in the educational process. Based on the results of the survey, the authors state that after the transition to distance education, the number of electronic devices used by each interviewed student increased by 96.6%, as well as the average time spent in front of the computer screen. About 80% of the parents reported that their children had more health problems related to working with a computer, and 60% of them reported symptoms typical of computer vision syndrome. Kolak - Markic - Horvat - Klemencic - Stojanac (2021) reports interesting findings where 10 545 respondents took part in the research, of which 88% were mothers and 12% were fathers. The author states, that the involvement of mothers in distance education is significantly higher than that of fathers. The findings showed that more parents revealed that most of them consider their children to be independent, even regarding the ability to control the computer during distance education. On the contrary, according to Lase - Zega - Daeli - Zaluchu (2021), the parents did not perceive distance education (Emergency Remote Education) negatively, even though it was an increased economic, psychological and social burden for them. Insufficient parental involvement and support during distance education, is generally due to a lack of time and the parents' inability to become teachers of their children. A surprising finding of this study was a decrease in the children's motivation towards learning. Parents hoped that distance education would not be extended.

Results of the research carried out around the world, which we have analysed in the paper, led us to investigate the opinions of

parents on distance education (Emergency Remote Education), in the 2021/2022 school year.

3 Research sample and research methodology

The research was carried out within the grant task VEGA No. 1/0550/22, Current status, trends and problems in technical education at the lower and upper secondary level of the school, in the context of distance education (ERE).

For a comprehensive processing of the given issue, we used the grant task VEGA No. 1/0550/22 package of research methods (conversations, questionnaires, interviews, pre-tests, post-tests, quasi-experiments and the SPSS program package version 2.0). A content analysis was used to map the current domestic and international research findings, scientific studies, new trends and problems, and concepts and content in a technical education implemented by distance education. The selected research methods made it possible to identify, analyse, systematise, and interpret the research findings.

For this partial research and the presentation of the partial results, we used the online questionnaire method.

Therefore, the objective of the paper, as well as our attention and research activity, is focused on examining the opinions of parents, on their experiences, on their support, and their direct involvement in the process of the distance education of their students in selected lower and upper secondary level of school in Slovakia, during the pandemic.

The research questions emerged from the research objective:

Q (1) How do parents perceive the willingness of schools and teachers to communicate and provide information about the organisation and course of distance learning?

Q (2) How do parents perceive their workload and psychological pressure during their children's distance education compared to face-to-face education?

Q (3) How do parents perceive their children's workload and problems during distance learning of their children compared to face-to-face education?

A total of 407 respondents took part in the large-scale research study which we are presenting, including 175 parents students of selected lower secondary school and 232 parents students of selected upper secondary school, to whom an anonymous original online questionnaire of our own construction was made available, in the period from March to April 2022. The online questionnaire contained 27 items with questions for the parents, with simple and multiple-choice answers, and also an assessment scale. The questionnaire also included open-ended items with the possibility to answer freely. Semi-closed items offer parents an open-ended choice in addition to the option to choose an answer. In the questionnaire, each item was evaluated separately. For closed items, we evaluated the frequency of responses for each option, which was then expressed as a relative number (%). The assessment scale was evaluated in the same way. For open and semi-closed items, we categorised the respondents' individual answers and then expressed their representation through percentages.

4 Results

The SPSS package of statistical tools - version 2.0 was used for the statistical processing of the results. In this section we present the results of one part of a large-scale research study, namely the part focused on finding out the opinions, experiences in supporting their children's parents during distance education in the time of the pandemic. From the results, we only comment on those which relate to the cooperation of parents with regards to the distance learning of their children.

Tables 1 and 2 present the research sample in terms of age and the highest level of education (first and second item of the questionnaire).

Table 1 Presentation of the research sample according to age.

Age of respondents	AM	MDN	SD	Skewness	Kurtosis	MIN	MAX
PS parents	43.245	44	5.882	.191	-.326	32	58
SS parents	45.047	45	5.071	1.07	3.76	34	73

Legend: AM - average mean value, MDN - median value, SD - standard deviation, Skewness - skewness coefficient, Kurtosis - slope coefficient, MIN - minimum value, MAX - maximum value

Table 2 Distribution of the research sample according to the highest level of education.

	PS Parents (vj)	SS Parents (vj)
Secondary education	0.44	0.75
University education	0.56	0.25

It follows from the above, that the parents of lower secondary school students [AM 43.2], who participated in the research study, were between 32 and 58 years old. Parents of upper secondary school students [AM 45.0], were aged 34 and 73 years old. The parents of lower secondary school students were more university- educated [vj 0.56], while among the parents of upper secondary school students, a secondary education [vj 0.75] dominated.

In the third item, the respondents indicated which grade of lower secondary school, or upper secondary school, their students attends. The majority of the parents of lower school students [vj 0.23] unanimously stated that their children attend the sixth and seventh grades. The least number [vj 0.15] of parents stated the ninth year of lower secondary school. Within upper secondary vocational schools, most parents [vj 0.32] stated the first year, while the least number of parents [vj 0.16] stated the fourth year of study.

From the presented research findings obtained from the fourth item of the questionnaire, we consider the most significant finding to be that the parents of lower secondary school students [AM 1.5] and the parents of upper secondary school students [AM 1.5] think that they were definitely provided with sufficient information about the organization and the course of distance education in a timely manner by the school (T3).

Table 3 Providing information on the organisation and course of distance learning.

	AM	MDN	SD	Skewness	Kurtosis	MIN	MAX
PS parents	1.509	1	.660	.940	-.235	1	3
SS parents	1.513	1	.757	.687	3.143	1	5

Legend: AM - average mean value, MDN - median value, SD - standard deviation, Skewness - skewness coefficient, Kurtosis - slope coefficient, MIN - minimum value, MAX - maximum value

Huřová - Tokoř (2022) state that Slovak education was not prepared for a sudden transition from face-to-face education to distance education (ERE). It happened overnight. Several problems arose which needed to be solved immediately. Based on the aforementioned findings, we conclude that the schools tried to solve the situation and provided parents with sufficient information about the organization and course of distance education in a timely manner. On the contrary, Abuhammand (2020) argues, parents experienced difficulties in implementing distance education (ERE) in terms of both communication and logistics. Our claims from the fourth item are also supported on research findings from the fifth item of the questionnaire, in which we asked parents about their communication with the teachers (T 4).

Table 4 Communication of teachers with the parents regarding problems and help.

	AM	MDN	SD	Skewness	Kurtosis	MIN	MAX
PS parents	1.6	1	.869	1.647	3.014	1	5
SS parents	1.439	1	.701	1.894	4.441	1	5

Legend: AM - average mean value, MDN - median value, SD - standard deviation, Skewness - skewness coefficient, Kurtosis - slope coefficient, MIN - minimum value, MAX - maximum value

The parents reported that lower secondary school teachers [AM 1.6] and upper secondary school teachers [AM 1.4] were definitely willing to communicate with them and help regarding problems with the distance education of their children.

The research findings also show that the intensity of parental support varied over time and depended upon the specific activity of the pupil and the type of school (T5).

Table 5 Support from the parents of pupils during distance education.

	PS Parents (vj)	SS Parents (vj)
throughout the day, during every online class or activity	0.04	0.00
only when he/she worked on assignments during the lessons	0.03	0.07
only when he/she worked on projects	0.21	0.03
only when he/she worked on homework	0.21	0.05
only when he/she needed help	0.76	0.53
I was not helping, he/she learning and working independently	0.23	0.48

Based on the above, it can be concluded that the support for lower secondary school students from their parents was significantly more intense than that of the parents of upper secondary school students. Up to [vj 0.48] of the parents of upper secondary school students claimed that they did not have time to support their children due to work or household responsibilities. Ibid Apriyanti (2020) states that some students did their school duties without parental supervision. These were primarily families with several siblings, and the parents could not devote themselves to just one child the entire time. Some children needed continuous supervision and inspection by their parents during the lessons. The results of the research showed weak support, supervision, and checking from some parents. Ibid Lase - Zega - Daeli - Zaluchu (2021) argues that the lack of involvement and support by parents in distance education (ERE) is generally due to a lack of time and the parents' inability to become the teachers of their children. We reached similar results in our study as well. In connection with the support by parents of their children, we further investigated whether Slovak parents were more stressed during their child's distance education than during face-to-face education at school (T6).

Table 6 Burden of the parents during the distance education of their students.

	AM	MDN	SD	Skewness	Kurtosis	MIN	MAX
PS parents	2.431	2	1.436	.694	-.824	1	5
SS parents	3.666	4	1.379	-.629	-.911	1	5

Legend: AM - average mean value, MDN - median value, SD - standard deviation, Skewness - skewness coefficient, Kurtosis - slope coefficient, MIN - minimum value, MAX - maximum value

From the presented research findings, it can be concluded that the parents of lower secondary school students [AM 2.4] and the parents of upper secondary school pupils [AM 3.6] were the most stressed in connection with distance education. The lower workload of the parents of upper secondary school parents is related to greater independence and responsibility.

In the next item, using an interval scale from 1 to 10, the parents expressed the degree of presence of increased psychological pressure when supporting, helping and replacing the work of the teacher, during the distance education of their children (T7).

Table 7 Psychological pressure of parents during the distance education of their children.

	AM	MDN	SD	Skewness	Kurtosis	MIN	MAX
PS parents	4.536	5	2.691	.228	-1.054	1	10
SS parents	3.400	3	2.585	.971	.065	1	10

Legend: AM - average mean value, MDN - median value, SD - standard deviation, Skewness - skewness coefficient, Kurtosis - slope coefficient, MIN - minimum value, MAX - maximum value

The obtained results show that the parents of upper secondary school students [AM 3.4] feel less psychological pressure when supporting their children during distance education than the parents of lower secondary school students [AM 4.5], whose level of help and support was undeniably more intense than for

students attending upper secondary schools. According to the Institute for Public Issues IPA (2021), the biggest problem on the part of the parents is the burden caused by the need for assistance with learning, with homework and with the solving of technical problems, but also with the coordination of employment or time off from employment.

The psychological pressure of parents is also influenced by the level of support from their employers (T8).

Table 8 Support for parents by employers during the distance education of their children.

	PS Parents (vj)	SS Parents (vj)
they gave me flexible working hours	0.07	0.01
they gave me paid time off	0.01	0.00
they gave me unpaid time off	0.01	0.09
they allowed me to work from home - home office	0.22	0.05
they didn't provide any support, I had to draw on Leave to Care for a Family Member, Pandemic Leave to Care for a Family Member, or other state support	0.09	0.04
they did not provide any support, I had to arrange the supervision by another person (e.g., a grandparent, etc.)	0.11	0.01
I did not have to stay at home	0.49	0.80

Based on the analysis of the obtained results for both groups of parents, we can conclude that employers did not provide any support to the parents of lower secondary school students [vj 0.11] or the parents of upper secondary school students [vj 0.01]. Only a small proportion of parents of lower secondary school students [vj 0.09] benefited from various government supports, while parents of upper secondary school students [vj 0.04] did not sufficiently cover the expenses associated with distance education.

In his study, Lau - Lee (2021) describes similar problems for the parents who demanded more flexible working conditions from employers, better subsidies from the state and better support from schools, which would facilitate distance education for the children. In his study, Abuhammand (2020) states that parents reported financial problems, because the purchase of the necessary technology and the costs associated with online education led to financial problems in many families.

The psychological pressure exerted on parents was also influenced by the considerable burden on students during distance education. (T9).

Table 9 The effect of distance education on the workload of the students.

	AM	MDN	SD	Skewness	Kurtosis	MIN	MAX
PS parents	2.311	2	1.213	.745	-.417	1	10
SS parents	2.771	3	1.345	.133	-1.291	1	10

Legend: AM - average mean value, MDN - median value, SD - standard deviation, Skewness - skewness coefficient, Kurtosis - slope coefficient, MIN - minimum value, MAX - maximum value

From the presented research findings, we consider the most significant finding that the parents of lower secondary school students [AM 2.3] and the parents of upper secondary school students [AM 2.7] think that distance education places a greater burden on their child than face-to-face teaching at school does. Agaton - Cueto (2021) presented in his study that parents struggled with personal problems related to health and stress, in addition to financial problems, which led to unsatisfactory results in the education of their children. The problems which parents are faced with when supporting their children were diverse and negatively affected the effectiveness, quality and achievement of the desired goals of distance education. In Table 10, we list the problems, which according to the parents, occurred most often during distance education.

Table 10 The most frequently occurring problems of the pupils during distance education.

	PS Parents (vj)	SS Parents (vj)
a lack of social contact with classmates within the school environment	0.61	0.62
a lack of social contact with the teachers	0.40	0.46
changes in the normal routine of the day	0.44	0.41
a lack of the usual morning habits	0.34	0.35
problems with insufficient technical equipment	0.08	0.13
problems with an insufficient internet connection	0.14	0.27
weak motivation to learn through distance learning	0.36	0.38
the problem of studying the curriculum independently	0.35	0.26
insufficient explanation of the curriculum by the teacher	0.29	0.27
problems with fatigue and a lack of concentration	0.17	0.22
manifestations of irritability	0.07	0.12
manifestations of being overworked	0.14	0.09
manifestations of exhaustion	0.17	0.13
too much time spent at the computer	0.70	0.64

Parents of lower secondary school students [vj 0.70] and the parents of upper secondary school students [vj 0.64] cite too much time spent on the computer as their children's biggest problem. Another problem was a weak motivation to learn, difficulty in studying the subject matter independently, as well as manifestations of being overworked and exhausted. The biggest problem was a lack of social contact with classmates and the teachers in the school environment. According to the Institute for Public Issues IPA (2021), up to 78% of parents identified the lack of personal contact of children with classmates, peers or friends as a major problem. Almost two-thirds of parents (69%), also identified a lack of contact with the teachers as a problem. Similar to our findings, according to the IPA, there were also less urgent problems directly related to learning, such as nervousness, a lack of concentration, irritability (46%), problems with misunderstanding the subject matter, inability to solve tasks independently (44%), fatigue and excessive workload as a result of a lot of responsibilities, and a lack of time for rest and fun (40%). Parents also reported a loss of habits and a change in the child's daily routine (68%), such as the daily habit of going to school, getting up regularly in the morning, fulfilling normal daily duties, etc.

In one of the items of the questionnaire, we asked parents to quantify the costs incurred by them in connection with their support in the transition of children to a distance form education (Table 11).

Table 11 Costs of parents in supporting children during the transition to distance education.

	PS parents (vj)	SS parents (vj)
up to 100€	0.21	0.32
from 101€to 150€	0.10	0.11
from 151€to 300€	0.12	0.06
from 301€to 450€	0.09	0.03
from 451€to 600€	0.08	0.04
from 601€to 750€	0.03	0.02
from 751€to 900€	0.06	0.03
from 901€to 1000€	0.03	0.03
more than 1000€	0.01	0.02
no costs	0.27	0.34

Parents also supported their children materially during distance learning. In this context, they declared increased expenses for energy and meals. Other investments went into increasing the volume of transferred data and the speed of the Internet connection. According to the PRservis portal (2020), an increased level of demand for telecommunication technologies was stimulated during distance education. According to a study by Huawei, the volume of data traffic has increased in Europe. As a result of school closures, the average number of active users of online education applications and programs has increased 8-fold.

By analyzing and processing the open-ended responses in the questionnaire items, we found that parents, in order to support their children, also invested in the purchase of desktop computers, printers, color toners, laptops, and peripheral devices needed for online communication such as headphones, microphones, etc. At the time of distance education, some schools lent school laptops to students, which contributed significantly to reducing the psychological pressure, stress and financial expenses of families.

Furthermore, we investigated whether parents think that their children's welfare has worsened as a result of distance education (T12).

Table 12 Parents' opinion on the welfare of their child during distance education.

	AM	MDN	SD	Skewness	Kurtosis	MIN	MAX
PS parents	3.296	3	1.298	-.101	-1.079	1	5
SS parents	3.587	4	1.307	-.498	-.960	1	5

Legend: AM - average mean value, MDN - median value, SD - standard deviation, Skewness - skewness coefficient, Kurtosis - slope coefficient, MIN - minimum value, MAX - maximum value

The findings show that the parents of lower secondary school students [AM 3.2] and the parents of upper secondary school students [AM 3.5] think that their child's performance has worsened as a result of distance education. Ostertáková - Rehúš (2021), also stated that up to 84.5% of teachers state that students have mastered less subject matter through distance education than during face-to-face teaching. Up to 75% of teachers estimate a loss compared to regular teaching in the range of three or more months. The reasons are a lack of motivation, insufficient technological equipment, access to the Internet and a lack of support from the parents. Half of the teachers think that the pupils' digital skills have improved thanks to distance education.

From the presented research findings obtained through an online questionnaire, we consider the most significant finding to be that as many as [vj 0.31] of the parents of lower secondary school students and [vj 0.36] of the parents of upper secondary school students have concerns that their child will not get a comprehensive knowledge through distance education, which will then be difficult to catch up in the future. In upper secondary vocational schools, up to [vj 0.49] of the parents are concerned that their child will not acquire the necessary skills through distance education, especially in the area of professional

technical subjects, which may cause them problems when applying for higher education or their future profession.

5 Conclusions

Due to the closure of schools and school facilities during the COVID-19 pandemic, distance education also dominated as an organisational form of education. It maintained its position during the two school years, 2019/2020 and 2020/2021, and hybrid education was already dominating in the 2021/2022 school year. The resulting situation led us to the implementation of a large-scale research study addressed within the framework of the grant task VEGA No. 1/0550/22 focused on the current state, trends and problems in technical education at the lower and upper secondary school, in the context of distance education (ERE). The results which we present are a part of it and are focused on finding out the opinions, experiences and support of parents in the education of students at selected lower and upper secondary vocational schools in Slovakia, during distance education at the time of the pandemic.

The answers to the research questions that emerged from the research objective were answered in the interpretations on an ongoing basis. Finally, we summarize the answers:

Q (1) *How do parents perceive the willingness of schools and teachers to communicate and provide information about the organisation and course of distance learning?*

Parents perceived and evaluated positively the willingness of the school and teachers to communicate and to provide them with sufficient and satisfactory information about the organisation and course of distance education.

Q (2) *How do parents perceive their workload and psychological pressure during their children's distance education compared to face-to-face education?*

Parents perceived their workload and psychological pressure during their children's distance education very negatively, for many of their children from the lack of social contacts even depressing compared to full-time education.

Q (3) *How do parents perceive their children's workload and problems during distance learning of their children compared to face-to-face education?*

Parents perceived their children's workload and problems during distance education as burdensome not only because of spending a lot of time on computers, but also because of many deficiencies associated with the facilities - computers, internet connections, their own learning space, and many others) compared to face-to-face education.

Based on the findings, it can be concluded that from the perspective of the parents, long-term distance education has had an adverse effect on their children. Distance education is challenging, and its success depends on many technical, psychological and psycho-didactic factors (Huřová, 2022). In order to achieve the effectiveness of education, even with such an organisational form, it is desirable that all participating entities approach teaching with maximum responsibility. From our point of view, these are primarily pupils, teachers, parents, and their employers, and many others. Several unfavourable factors can be eliminated with the support of the parents and a responsible approach by everyone involved. But despite this, the research data obtained from the parents of lower and upper secondary school students show that, according to them, it is not possible to fully replace face-to-face education. According to Huřová -Tokoš (2022) there are obstacles which can only be removed with great difficulty, or not at all. These mainly concern upper secondary vocational schools and technical education, in which psychomotor educational objectives dominate. Almost half of the respondents fear that their children will not acquire the necessary skills in the field of technical education through distance education, which can lead to problems when applying to the job market or studying at technical universities. The above shows that for a number of vocational for a number of vocational subjects, including vocational training and apprenticeships, distance education is not appropriate. We also found that parents of lower secondary

school students felt the greatest problems, obligations or burdens.

We believe that one of the reasons for this is the fact that the student is less independent by the age of 15 and therefore the parent feels more responsibility for the student and the need to devote more attention.

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Primary Paper Section: A

Secondary Paper Section: AM

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

IMPACT OF LONG-TERM ELECTROMAGNETIC FIELD EXPOSURE ON SACCHAROMYCES CEREVISIAE: CONTROLLING THE INOCULUM WEIGHT

^{a,b}MAREK BAJTOS, ^bNHAT DANG, ^aROMAN RADIL,
^aLADISLAV JANOUSEK, ^aKRISTINA PAULECOVA

^aUniversity of Zilina, Univezitna 8215, Zilina, Slovakia

^bUniversity of Colorado Boulder, 552 UCB, Boulder, CO, USA
email: ^amarek.bajtos@feit.uniza.sk, roman.radil@feit.uniza.sk,
ladislav.janousek@feit.uniza.sk, ^bnhat.dang@colorado.edu

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Abstract: Living organisms of *Saccharomyces cerevisiae* are subjected to extremely low-frequency electromagnetic field exposition during the workweek, followed by cultivation over the weekend. Initially, the weight of the inoculum with YPD agar is examined in the exposure setup without exposition between the first and the last day. Subsequently, the coil is supplied, generating a static and time-varying electromagnetic field. The theoretical assumption underlying this experiment is based on the modified ion parametric resonance theory, which specifically focuses on calcium ions at a frequency of 192.26 Hz. The time-varying magnetic field amplitude is set at 451.66 μ T, accompanied by a static field of 250.92 μ T. By employing an experimental protocol, the cells are exposed to these conditions for a long-term exposition within Petri dishes.

Keywords: extremely low-frequency electromagnetic field, exposition of cells, the mass ratio

1 Introduction

Electromagnetic field (EMF) exposure has been used in many different applications to modulate biological processes across industries. Pulse and alternating EMF have both been shown capable of stimulating and inhibiting different plant growth, with a focus on important agricultural crops such as corn and barley [1,2,3].

EMF treatment has been proposed as a cost and time-effective method to remove bacterial biofilm and scale build-up on ships and other infrastructure and has gathered increasing interest from both the military and commercial business [4]. Combined, these applications possess tremendous financial and economic impact in the orders of thousand-billions of United States dollars per year as seen in Figure 1. On more human-centric applications, pulse EMF has been shown to be able to induce vestibular response and offer a new method to study motion sickness and spatial disorientation [5]. In addition, EMF therapeutic applications can target issues such as pain and inflammation reduction, skeletal tissue healing, and even treatment of neurological diseases [6; 7; 8].

Taking a closer look at these applications, EMF of different parameters can have both positive and negative effects on biological systems, especially on cell activity and viability; and though well-observed, the EMF exact interacting mechanism with biochemical systems is still poorly understood. As such, it is a challenging task to set relevant safety limits for when

considering its exposure effect on human health, a rising concern.

With the recent global commercialization of fifth generation (5G) telecommunication technology, there has been a renewed interest among the public in the health effect of EMF exposure. Looking broadly, in the modern environment, EMF can arise from a wide variety of sources and parameters, from commercial power distribution systems to your smartphones. According to the National Institute for Occupational Safety and Health, the three main categories of concern for EMF exposure are radio frequency, extremely low frequency, and static magnetic fields.

EMF exposure may be considered a cellular physical stressor and a possible carcinogen, though this issue remains controversial for non-thermal level of exposure. Thus, the exact cause-effect relation has yet to be established. Studies have shown that many processes and components have been identified to be able to be modulated by external magnetic field [9, 10, 11].

At the same time, many epidemiological studies have indicated a rise in human cancers occurrence since the advent of electricity, drawing correlation to the increased exposure to EMF in modern time [12]. A study from Shih et al. [13], shows that there is a significant correlation between smartphone usage and distance from their chest to increased incident of breast cancers at up to 5-fold.

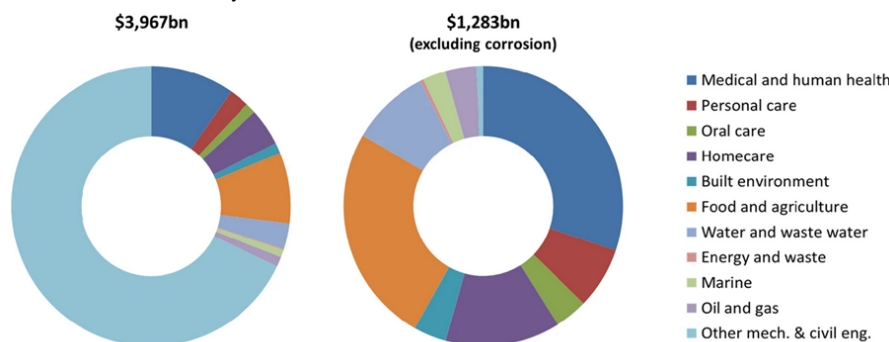
Due to both the large amount of exposure parameters (different waveforms, frequencies, amplitude, time of exposure, and combination of the above and more) and the many feedback system present in cellular activities (not accounting for variation between cell types, species, and individuals), the observed result is non-linear and challenging to pinpoint the result to a single mechanism. Despite the difficulty mentioned above, investigating cellular growth rate is the first step to help fill in part of the puzzle, what is point of this contribution.

2 Materials and Methods

In the study conducted by Bajtos et al. [17], an experimental protocol was established to investigate the long-term exposure of cells cultivated on Petri dishes. The primary focus of the study was to address the following questions:

1. How does the mass of the YPD agar change over time?
2. How does the mass of the YPD agar with cell culture change over time?

By systematically monitoring the mass variations of the YPD agar, in this contribution, it is aimed to understand the dynamics of the growth medium and its potential impact on cell culture.



Corrosion has been removed from the right chart to expand the viewing of the other sectors.

Figure 1. Worldwide economic losses associated with biofilm persistence disaggregated by commercial sector. Left: Corrosion (light blue) dominates industrial economic losses; Right: corrosion loss equivalents are excluded from chart to improve sector resolution. Adapted from [4].

Subsequently, two tests, named Test A and Test B, were carried out to examine the influence of extremely low-frequency electromagnetic field (ELF-EMF) on the growth of living organisms. The experiments were designed to explore the effects of ELF-EMF exposure on cell growth, considering the mass changes of the YPD agar.

The experimental protocol established in this study lays a solid foundation for the investigation of long-term effects of ELF-EMF on cell growth, presenting opportunities for scientific and practical advancements. To ensure reliable and accurate results, the experimental setup incorporates exposed and control coils for conducting paired experiments.

In terms of the biological component, the study employs *Saccharomyces cerevisiae* cells, commonly known as wine or beer yeasts. These cells serve as a suitable model organism due to their well-characterized biological properties and genetic tractability. By using *Saccharomyces cerevisiae*, it is possible to gain valuable insights into the effects of ELF-EMF on cellular processes and growth dynamics.

For more detailed information regarding the experimental setup, the biological procedure of YPD agar preparation, and cell handling, it is encouraged to refer to the work of Judakova [18]. Judakova's research provides additional information on the specifics of the experimental design, including the instrumentation, coil configurations, and other technical details essential for replicating and further exploring the study's findings.

Even though it is difficult to understand all processes in the biological aspect of how ELF-EMF can interact with the cells, it is probable, that more than 1 mechanism can occur. Some of the low energy electromagnetic effects on micro-biological systems are well documented in laboratory experiments but are difficult to translate to macro-biological system responses.

Reproducing the results may differ because of the difference in exposure setups, experimental conditions (alternative or static magnetic field), the frequency, intensity, duration time of magnetic field, the time of recovery, investigation targets, assay methods, etc. What more, when similar exposure time and intensity of magnetic field have been used in studies [19], [20] to determine the DNA damage, contradictory results attracted attention. The results should differ either because of the combination of different mechanisms responding to ELF-EMF.

2.1 Mitochondria, Electron Transport Chain and Radical Oxygen Species

Mitochondria are organelles found in eukaryotic cells that play an important role in cell function. The most significant role of a mitochondrion is the process of obtaining energy. The energy is obtained by breaking down saccharides, lipids, or other energetically rich organic substances. Mitochondria are usually oval-shaped and have two membranes: an outer and an inner membrane. The outer mitochondrial membrane isolates the mitochondrion from the rest of the cell. The inner membrane is crimped, which makes mitochondrial cristae that make its surface larger. This membrane contains the enzyme system, which is responsible for intracellular respiration. This is the site where saccharides degrade, and the energy is released into adenosine triphosphate (ATP) molecules. Aside from that, each mitochondrion has its own DNA and ribosomes, allowing it to reproduce and synthesize proteins. [21]

The four protein complexes: Complex I, Complex II, coenzyme Q, Complex III, cytochrome C, and Complex IV, make up the electron transport chain (ETC). These complexes act as an electron transport system. The energy is released as ATP when the reduction potential is larger. The energy is used to drive a proton gradient by pumping hydrogen ions out of the mitochondrial matrix into the space between membranes. Different kinds of clusters participate in the reactions, which are

responsible for the transport of electrons, along with the complexes themselves and their catalytic processes [22], [23].

Iron-sulphur (Fe-S) clusters are part of the metalloprotein class. There are different types of clusters, but the most common ones are [2Fe-2S], [3Fe-4S], and [4Fe-4S]. All these types of clusters play a crucial role in complexes of ETC. Their configurations specify the electron transport channels that power mitochondrial respiration. The structure of [2Fe-2S] is rhombic. It is part of ferredoxins and has a role in the synthesis of steroids. [4Fe-4S] clusters have a cubic structure, and they can be found in mitochondrial respiratory complexes. The other important role of clusters is in DNA metabolism, and they work as cofactors in the catalysis of enzymes. [23]

A set of metabolic processes in the mitochondria that produce ATP are referred to as "oxidative phosphorylation". Nicotinamide adenine dinucleotide hydride (NADH) and flavin adenine dinucleotide (FADH₂) are carriers of electrons. While electrons are passing through ETC, protons are pumping from the mitochondrial matrix between the membranes of the mitochondria, resulting in the formation of the transmembrane electrical potential. To help electrons go through ETC, Fe-S clusters are used. In Complexes I and II, Fe-S clusters transfer electrons from the carriers NADH and FADH₂ to ubiquinone. In Complex III, the role of Fe-S clusters is to make the transfer of electrons to Complex IV easier. [23]

The production of ROS is the main problem with ETC. "Complex I is considered to be the main producer of reactive oxygen species within mitochondria." [23] ROS can also be produced in Complexes II and III. This production is associated with the emergence of various diseases. Redox signalling in oxygen-sensitive tissues is significantly influenced by ROS generation from Fe-S clusters. Reversible redox alternation at the Fe-S clusters may play a critical role in sensing variations in oxygen tension. These changes in ROS generation may also affect the Fe-S clusters themselves.

The question is whether magnetic fields can affect Fe-S clusters in ETC. In the research of Toda et al. [24], the authors show the impact of the extremely low frequency weak magnetic fields (ELF-WMF) on mitochondria and complexes in ETC. In experiments, they used ELF-WMF in pulses of 10 μ T and intensity at 1-8 Hz. ELF-WMF reduced the number of mitochondria. This field suppresses all four subunits that comprise Complex II. They also demonstrated that ELF-WMF induced mitophagy by hermetically stimulating mitochondrial ETC activity and inhibiting mitochondrial Complex II activity.

According to Barnes and Beeningham [25], transitions in weak combined steady and time-varying external fields can change the relative orientation of the total angular momentum of two radical pair members, which in turn can change whether their relative electronic states are S or T. This results in a change in the total molecular angular momentum **F**. For instance, if a process produces a pair of radicals that are in a T state with respect to one another, then the recombination rate of those radicals may be impacted if one encounters a time-varying field with a frequency corresponding to the hyperfine splitting brought on by the external static field, which shifts the combination to a relative S state. The modification will decrease the number of radicals that are free to drift off and increase the number that recombines into stable molecules for chemical reactions that initially generate radical pairs in T states. The same would apply to a pair that is initially created in a relative S state and is subsequently changed by an applied field into a relative T state.

Finally, it is proposed that observable magnetic field effects may typically occur in conditions where an organism is stressed by other factors that change the radical concentrations, pushing the radical concentrations outside the range of values where they can be mitigated by radical scavengers.

If this is the case, it may help to explain why it can be difficult to obtain repeatable results because the initial conditions in biological systems are difficult to duplicate. In experiments

human related, this is particularly true. In many animal experiments, the conditions are designed to eliminate other stresses so that the compound effects of magnetic field stress and other stresses are not seen. It is to be noted that radicals are generated as a part of the metabolic processes and their values may vary by more than a factor of 10.

However, while these radicals are produced, a signal is sent to produce radical scavengers, and the concentrations are reduced to a baseline level. Long-term elevations of radical concentrations can damage and reset the baseline [26]. This in turn may lead to the reason why long-term exposure to cell phones may be different from short-term exposure.

Many interesting molecules' and radicals' coupling constants are not measured. Although the interdependence between nuclear and electronic states in solution is obvious and measurable, for example, in line shifts and broadening of NMR and EPR spectra, some of the measurements or theories used are for isolated molecules and may not be directly applicable for the case of molecules and radicals in physiological settings. Understanding of how weak magnetic fields can affect biological processes could be greatly improved by conducting experimental tests of the proposed hypotheses and variations in the theories that include excitations at both RF transition frequencies for the Zeeman states of the electrons and modulation at frequencies in the 5-500 Hz region.

2.2 Experimental Setup

In the experiment, a Q-Cell series incubator (Hanwha Solutions, China) is used. It is an equipment made to store samples and incubate microorganisms at a precisely controlled temperature while upholding the strictest standards for stability and homogeneity. Q-Cell incubators have a combined cooling and heating system with forced air circulation. It allows for operation at temperatures that are like or below ambient. The typical temperature range is from 3 to 40 °C, with an optional increase to 50 or 60 °C. The temperature can be regulated through an LCD display with 0.1 °C precision.

In the Q-Cell incubator in the laboratory, two coils are located: one powered and one controlled. Inside the coils is the support system for 10 samples of storage (each coil contains 5 samples). Between the coils is a shielding plate. Each coil is made of wound copper wire with an average diameter of 1 mm and a length of 912 m for each coil. The number of windings is 2000. The incubator with the coils is shown in Figure 2.

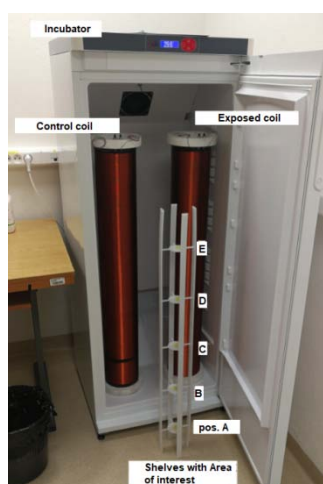


Figure 2. Experimental setup used for the experiments.

For the coils, it is necessary to consider their current carrying capacity. The current carrying capacity of the conductor is based on the cross-section of the conductor and the material from which it is made. As mentioned above, the material is copper, and the average diameter is 1 mm. For calculating the conductor cross-section, the elementary formula for calculating the content

of a circle is used. According to the table in the book by Meravy and Kroupa [27], for a cross-section of 0.75 mm², the current carrying capacity for copper wire is 6 A.

In the experiment, an extreme-broadband power amplifier model HUBERT A1110-16-E (Dr. HUBERT GmbH, Germany) is used. With this model, both a voltage amplifier and a current amplifier can be used. For inductive loads, the current amplifier provides a constant, frequency-invariant output current.

It is a four-quadrant voltage and current amplifier with a maximal output voltage of 75 V_p and a maximal output current of 28 A_p. In the current amplifier mode for inductive loads, there are six configurable compensation networks. When operating in current control mode, the A1110-16-E operates similarly to a voltage-controlled current source and provides an inductive load with a practically frequency-independent constant load current.

The 34401A Digital Multimeter (Keysight Technologies, USA) is a multimeter with a 6.5-digit resolution. It offers 10 measurement functions, including DC/AC current, DC/AC voltage, 2-wire and 4-wire resistance, frequency, period, diode, and continuity. The maximal voltage input is 1000 V, and the maximal current input is 3 A. Its accuracy is 0.0035% for DC and 0.06 for AC.

The RIGOL DG4162 generator (RIGOL, Technologies, China) from the DG4000 series was used as a generator. DG4000 series is a multifunctional generator that can be used as a harmonic, pulse, function, or arbitrary waveform generator, analog/digital modulator, and counter. The generator has two channels, and the maximal frequency is 160 MHz.

2.3 Test A – Growth Rate Without EMF Exposure

To ensure that cells remain in the stationary phase rather than entering the phase of death during the 7-day cultivation period, Test A was conducted to determine the optimal growth conditions. Based on the findings of Lin et al. [28], it was determined that maintaining the temperature within the range of 10 to 20 °C in the incubator is crucial. To extend the stationary phase of yeast cells and slow down their growth, a temperature of 15 °C was selected for cultivating the samples. As this experiment does not involve exposition, the hypothesis suggests that both control and exposed samples placed on different coils will exhibit similar decreases in mass.

In Test A, two YPD mediums were prepared, differing in the duration of pre-cultivation on a shaker. The first medium was agitated for 26 hours, while the second medium underwent agitation for 20 hours. Subsequently, a dilution of 1:10 was performed for both mediums to ensure similar initial conditions for the samples. The concentration of the first medium was measured to be 317,778 cells/ml, whereas the concentration of the second medium was determined to be 247,333 cells/ml.

The incubator was set to a temperature of 15 °C, and 10 Petri dishes (PDs) were inoculated with the first medium, marked as number 1, while another set of 10 PDs were inoculated with the second medium, marked as number 2. Each inoculum consisted of 100 µl. To account for different conditions, five control samples and five exposed samples were prepared from each concentration. These samples were labelled as Control coil (C) or Exposed coil (E) depending on the coil they were placed in. The final designation of each sample included the coil (C/E), the medium used (1/2), and the position in the coils (A/B/C/D/E).

During Test A, the samples were placed in the incubator, and their weights were measured at the beginning and end of the 7-day experiment. Although the incubator temperature rose to 21.9 °C briefly when the samples were initially placed, it stabilized at 15°C after 22 minutes.

2.4 Test B – Growth Rate With EMF Exposure

In Test B, the preparation of YPD medium and agar plates takes place one day before the inoculation. The YPD medium is

prepared by placing one loop of yeast on a shaker for 24 hours. On the day of inoculation, a dilution of 1:10 is performed, and the concentration of the resulting solution is determined using Formula 2.1, which yields a concentration of 266,667 cells/ml.

$$V_2 = V_1 \cdot \frac{c_1}{c_2}, \quad (2.1)$$

where V_1 [μl] is the original volume used in the previous experiment, V_2 [μl] is the required volume needed to ensure the same beginning condition as in the previous experiment, c_1 [cells/ml] is the concentration calculated in the previous experiment, and c_2 [cells/ml] is the new calculated concentration. The volume for the first group of samples is 119 μl and 93 μl for the second group.

The null hypothesis for this experiment in Test B is like that of Test A. The prediction states that the mass of the exposed samples will undergo changes like the mass of the control samples. However, in this case, the exposition is turned on, meaning that the cells are subjected to the EMF.

In Test B, the samples are labelled following the same convention as in Test A: using the coil designation (C/E), the medium used (1/2), and the position in the coils (A/B/C/D/E). Once labelled, the samples are measured and then placed in the incubator, where the temperature is maintained at 15 °C, as in previous test.

After the samples are properly positioned, the parameters of exposition determined in the next chapter are configured in the generator, and the amplifier is switched on. This ensures that the desired EMF exposition is established.

The exposition is initiated every working day for a duration of 6 hours, beginning at the same designated time. Initially, the exposition time is set for 5 consecutive days.

Following the 5-day exposure phase, the subsequent two days serve as rest days, constituting the weekend. After the weekend period, the samples are measured again to assess any changes that may have occurred because of the electromagnetic field exposition.

2.5 Exposition Setting

For Test B, the establishment of parameters for exposure is crucial, and these parameters are determined based on the Ion Parametric Resonance (IPR) theory. In this study, the focus is on the role of Ca^{2+} ions, as they play a significant role in proper human body function, as proposed in the IPR model [29], [30].

To calculate the AC frequency, Formula 2.2 from the IPR model is employed. This is essential for determining the parameters of exposure, specifically for characterizing the frequency variation over time, denoted as f_{AC} [Hz]:

$$f_{AC} = \frac{1}{n} \cdot \frac{qB_{DC}}{2\pi m} \quad (2.2)$$

where B_{DC} [T] is the DC magnetic flux density, q [C] is the charge of the charged particle, m [kg] is the mass of the charged particle, and n [-] is the frequency index. This formula describes how the frequency of an applied AC field depends on the static magnetic field density. According to the study of Bajtos et al. [30], the designated AC frequency adjusts proportionally with the change of the magnetic flux density.

It is important to note that the frequency variation over time, as described by Formula 2.2, impacts the static magnetic flux density. The frequency is one of the parameters that need to be set in the system to achieve the desired exposure. As noted by Bajtos et al. [30], increasing the static component of the magnetic flux density can help mitigate the effects of the Earth's magnetic field, which changes over time. These considerations and the utilization of Formula 2.2 allow for the determination of appropriate parameters for the exposure in Test B.

Considering the limitations in increasing the static magnetic flux density, this research specifically focuses on ELF-EMF and its impact on living cells. According to a study conducted by Toutou and Selmaoui [31], extremely low frequencies ranges between 1 and 300 Hz. Therefore, the calculated frequency must fall within this required limit.

In laboratory, the magnetic field strength of the Earth is measured to be approximately 50.92 μT . For this experiment and to satisfy one of the postulates of IPR, which is the collinearity of B_{DC} (static magnetic field) and B_{AC} (applied AC magnetic field), a magnetic flux density of 200 μT is chosen. This value ensures the neglect of the Earth's magnetic field. Subsequently, in Formula 2.2, the sum of the mentioned values, 250.92 μT , is substituted [30], [32].

To further calculate the AC frequency in Formula 2.2, additional values need to be included. As for the charge of the charged particle, q [C], the smallest positive electric charge is considered. Since calcium has an oxidation number of 2+, the charge is multiplied by 2. As for the mass of the charged particle, m [kg], the atomic mass of calcium, which can be obtained from the periodic table, is utilized. The periodic table generally provides the relative atomic mass, which represents the ratio of an element's average atomic mass to the unified atomic mass unit (Dalton unit). To calculate the mass of the calcium ion, the relative atomic mass is multiplied by the unified atomic mass unit, which is approximately $1.66 \cdot 10^{-27}$ kg. Lastly, the frequency index, n [-], is selected as 1. The calculation of the AC frequency can be performed using Formula 2.3 [29], [30]:

$$f_{AC} = 1 \cdot \frac{2 \cdot 1.602 \cdot 10^{-19} [\text{C}] \cdot 250.92 \cdot 10^{-6} [\text{T}]}{2 \cdot \pi \cdot 40.08 \cdot 1.66 \cdot 10^{-27} [\text{kg}]} = 192.26 [\text{Hz}]. \quad (2.3)$$

The calculated frequency falls within the range of ELF, indicating that the selection of an increased static magnetic flux density was appropriate. This ensures that the experiment aligns with the desired frequency range. It is expected that the biological reaction will be more pronounced when this condition is fulfilled.

To calculate the currents, both static and varying magnetic flux densities are required. In this case, the varying magnetic flux density is determined to be 1.8 times the static value. This choice is made with the expectation that the biological reaction will be stronger under these conditions [33]. The specific value for the AC magnetic flux density can be obtained using Formula 2.4 [32].

$$B_{AC} = 1.8 \cdot 250.92 [\mu\text{T}] = 451.66 [\mu\text{T}] \quad (2.4)$$

Utilizing Formula 2.5, one can determine the AC and DC currents.

$$I = \frac{B - 20.443}{2183.6} \quad (2.5)$$

Using Formula 2.4, the DC, I_{DC} [A], where the value of B_{DC} [μT] is substituted for the position of B , is 105.55 mA. The AC, I_{AC} [A], where the value of B_{AC} [μT] is substituted instead of B , is 197.48 mA [33].

3 Results

The primary objective of this study is to examine the cellular proliferation response when exposed to EMF. The proliferative response may vary among cells. In a study conducted by Carnecka et al. [32], it was observed that exposure to ELF-EMF had an inhibitory effect on two samples, while three other samples exhibited a stimulating effect. Their study focused on the impact of Mg^{2+} in a liquid medium and was conducted under conditions similar to those employed in this present work.

This work has the objective of determining the exposure parameters and evaluating the results based on the IPR theory.

The weight of the samples is chosen as the primary parameter for comparing the results before and after exposure. The yeast strain *S. cerevisiae* is cultivated on PDs for a duration of 7 days. Prior to each experiment, a null hypothesis is established, and its validity is assessed by comparing the p-value to a significance level of 0.05.

The data obtained from each experiment do not exhibit a normal distribution, as indicated by the Kolmogorov-Smirnov test. To compare multiple samples, the Kruskal-Wallis's test is employed, while the Mann-Whitney test is used for comparing two samples. All the necessary calculations are performed using MATLAB (Mathworks, USA) [35].

For Test A, the results after 7 days of cultivation at 15°C are shown in Figure 3.

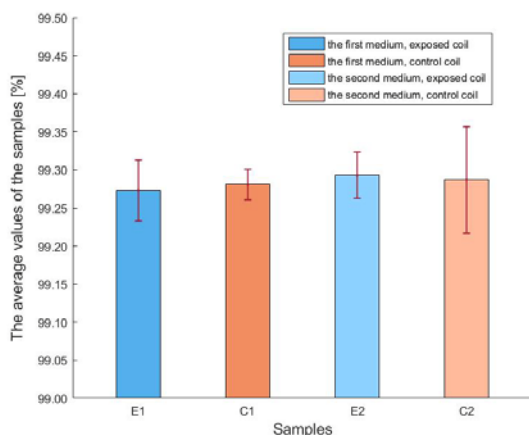


Figure 3. The mass ratio average values of the samples of two different concentrations after 7 days of cultivation at 15 °C in incubator with no exposition.

To evaluate the validity of the second hypothesis, we compare the samples of the first and second concentrations between the E and C coils using the Kruskal-Wallis's test. The results of the test indicate a p-value of 0.64. Since this value exceeds the significance threshold of 0.05, we conclude that there are no significant differences observed. Therefore, it is likely that the second hypothesis, which suggests that the change in mass for all samples is the same, holds true.

During Test B, the concentration of the diluted inoculum is determined to ensure consistency with Test A. By calculating the necessary volumes, the desired concentrations are achieved and subsequently pipetted onto agar plates. Additionally, parameters are configured to enable the exposition.

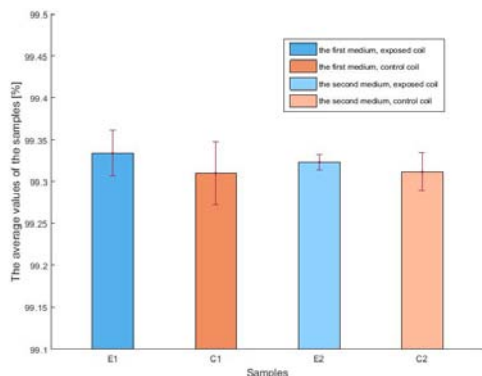


Figure 4. The mass ratio average values of the samples of two different concentrations after 7 days of cultivation at 15 °C in incubator with the exposition.

The obtained results from Test B are then compared and visually presented in Figure 4 allowing for a comprehensive analysis and interpretation.

The comparison of the control and exposed samples for the first concentration yields a p-value of 0.31, while for the second concentration, it is 0.57. Furthermore, when considering all samples from both the control and exposed coils, the Kruskal-Wallis's test calculates a p-value of 0.42. These results indicate the absence of a significant effect. Thus, it supports the prediction that the hypothesis stating an equal decrease in all samples holds true.

To provide a more detailed depiction of the findings, Figure 4 presents the average values and standard deviations (SDs) of the samples. Notably, the exposed samples exhibit higher average values compared to the control samples. Additionally, the SDs of the exposed samples are smaller than those of the control samples. This observation contrasts with the results from Test A, as depicted in Figure 3. Although these changes could potentially be random, they might also indicate a proliferative change in cells under the influence of electromagnetic fields.

4 Discussion and Conclusion

This contribution focuses on investigating the potential impact of ELF-EMF on living organisms. To conduct the study, an experimental protocol is developed based on the IPR theory. The model organism selected for this investigation is *S. cerevisiae*, cultivated on PDs.

The proliferative activity of the cells is monitored by measuring the mass of the samples. The confirmation or refutation of hypotheses related to Test A and Test B is determined based on the p-value, considering a significance level of 0.05. Additionally, standard deviations (SD) are calculated for each test.

Test A examines the behaviour of cells in the incubator without any exposure to ELF-EMF. Test B is designed to simulate Test A but with the inclusion of exposure. In the control coil, the control samples are subjected to normal growth conditions. The experiment begins with five consecutive days of exposure, where each day follows the same schedule of six hours of exposure. The following weekend is designated as a non-exposure period. At the end of the experiment, the mass of the samples is compared to the initial mass. Based on the calculated p-value, no significant changes in the mass ratio between the control and exposed samples were observed during the exposition.

It is worth noting that the impact of ELF-EMF on the proliferative activity of cells may be more evident when the cultivation temperature is higher or when different parameters of exposure are employed. During this research, other potential parameters for comparing the results were discovered. Notable changes were observed in the appearance of the samples. While the growth area of cells reaches full coverage during cultivation at room temperature, at 15°C, distinct regions of varying growth levels can be observed. Other interesting parameters to monitor include the concentrations of yeast metabolic byproducts, as well as the size, shape, and number of budding cells observed under a microscope.

Nowadays, a good question stays: how complex could biological cells be in context with their interaction with ELF-EMF? Despite IPR theory, the resonance of molecules could occur due to a magnetic moment associated with the nuclear spin of a molecule/compound in the biological system. This resonance could be aided in changing the rate of transitions in a molecule and hence changing the rate of recombination in a chemical reaction. The next interaction could be explained by The Feedback Effect. For example, if you push a swing at the top, you increase the amplitude and if you push at the bottom in the same direction, you decrease it. [25] Therefore, the timing of an electromagnetic pulse concerning oscillating biological processes can lead to either positive or negative effects. Two or

more different mechanisms can likely be causing the response when exposed to magnetic fields.

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Primary Paper Section: B

Secondary Paper Section: BG, BO

SOME IMPROVEMENTS OF THE GENETIC ALGORITHM FOR QUEUEING THEORY

^aPAVOL ORŠANSKÝ, ^bVLADIMÍR GULDAN
Department of Applied Mathematics, The Faculty of Mechanical Engineering at the University of Žilina, Univerzitná 8215/1, 010 26 Žilina, Slovakia
 email: ^apavol.orsansky@fstroj.uniza.sk,
^bvladimir.guldan@fstroj.uniza.sk

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Abstract: In this work, we deal with the use of optimization methods of the genetic algorithm queueing theory. Concrete for the optimization of production process plans in serial production. Specifically, we deal with the creation of an optimal sequence of production processes with regard to time and economic savings. In addition to the classically used genetic algorithms, we will focus on their improvements, such as the Tabu search, the penalty algorithm and simulated annealing. The simulation modeling took place in the Matlab environment.

Keywords: Optimization, Genetic algorithm, Simulated annealing.

1 Introduction to optimization flow-shop scheduling

Optimization is the search for the best solution from a set of possible solutions. In this case, we do not understand the term "solution" only in a strictly mathematical sense, such as solving an equation. Optimization deals with the search for the global minimum (or maximum) of functions of many variables with respect to possible limiting conditions. Many tasks from both engineering practice and natural sciences correspond to this general definition.

Flow-shop scheduling is an optimization problem in computer science and operations research. It is a variant of optimal job scheduling. In a general job-scheduling problem, we are given n jobs J_1, J_2, \dots, J_n of varying processing times, which need to be scheduled on m machines with varying processing power, while trying to minimize the makespan – the total length of the schedule (that is, when all the jobs have finished processing). In the specific variant known as flow-shop scheduling, each job contains exactly m operations. The i -th operation of the job must be executed on the i -th machine. No machine can perform more than one operation simultaneously. For each operation of each job, execution time is specified. The flow shop problem is a special case of the job shop problem.

There are m machines and n jobs. Each job contains exactly m operations. The i -th operation of the job must be executed on the i -th machine. No machine can perform more than one operation simultaneously. For each operation of each job, execution time is specified.

Operations within one job must be performed in the specified order. The first operation gets executed on the first machine, then (as the first operation is finished) the second operation on the second machine, and so on until the m -th operation. Jobs can be executed in any order, however. Problem definition implies that this job order is the same for each machine. The problem is to determine the optimal such arrangement, i.e., the one with the shortest possible total job execution makespan. [1]

The planning problem generally belongs to NP-complete problems (nondeterministic polynomial-time complete). This means that the time required to solve an NP-complete problem grows asymptotically faster than polynomially (usually exponentially) with the size of the problem input (instance). The consequence is that the time required to solve even moderately large instances of NP-complete problems easily reaches billions or trillions of years using any amount of computing power available today. This is also why the question of whether it is possible to solve NP-complete problems efficiently is one of the central questions of computer science today. [2]

More extensive problems must be solved by heuristic methods, which do not guarantee finding an optimal solution, nor can they

determine how close to the optimum a certain admissible solution is but are able to provide a "satisfactory" solution in a reasonable time. Evolutionary algorithms based on biological knowledge are a special chapter of heuristic algorithms. The disadvantages of these algorithms include the probabilistic nature of the results. This means that a different result may occur after each run. Among the basic and best-known evolutionary algorithms at the present time is so called genetic algorithm and its improvements such as the Tabu search, simulated annealing and the penalty algorithm.

2 Genetic algorithm

The genetic algorithm (GA) is a method for solving optimization problems that is based on natural selection, the process that drives biological evolution. It was pioneered by John Holland (1975) and his students at the University of Michigan. [3] The GA repeatedly modifies a population of individual solutions. At each step, the genetic algorithm selects individuals from the current population to be parents and uses them to produce the children for the next generation. Over successive generations, the population "evolves" toward an optimal solution. The genetic algorithm is a non-deterministic method of problem solving based on the principles of Darwin's theory of evolution. Each solution to the problem is called a chromosome and is made up of a binary string of a given length, which is the same for all chromosomes of the given population. A population is a finite set of chromosomes.

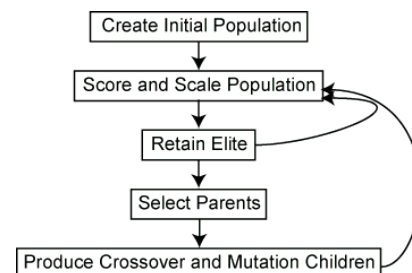


Figure 1: This flow chart outlines the main algorithmic steps.

The GA uses three main types of rules at each step to create the next generation from the current population:

Selection rules select the individuals, called parents, that contribute to the population at the next generation. The selection is generally stochastic and can depend on the individuals' scores.

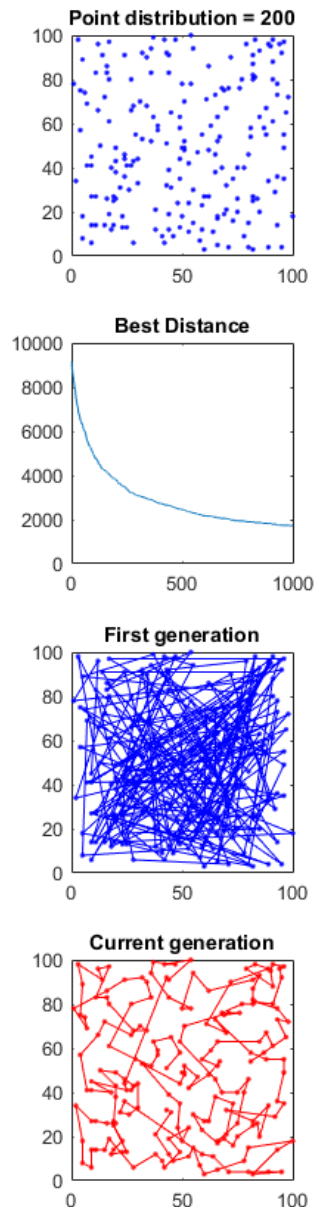
Crossover rules combine two parents to form children for the next generation.

Mutation rules apply random changes to individual parents to form children.

The selection is based on the fitness function. The fitness function is the function you want to optimize. For standard optimization algorithms, this is known as the objective function. The fitness value of an individual is the value of the fitness function for that individual. To create the next generation, the genetic algorithm selects certain individuals in the current population, called parents, and uses them to create individuals in the next generation, called children. Typically, the algorithm is more likely to select parents that have better fitness values.

The algorithm creates crossover children by combining pairs of parents in the current population. At each coordinate of the child vector, the default crossover function randomly selects an entry, or gene, at the same coordinate from one of the two parents and assigns it to the child. For problems with linear constraints, the default crossover function creates the child as a random weighted average of the parents.

The algorithm creates mutation children by randomly changing the genes of individual parents. The GA differs from a classical, derivative-based, optimization algorithm in two main ways. GA generates a population of points at each iteration. The best point in the population approaches an optimal solution, unlike classical algorithm, which generates a single point at each iteration. The sequence of points approaches an optimal solution. GA selects the next population by computation which uses random number generators, unlike classical algorithm, which selects the next point in the sequence by a deterministic computation. [4, 5]



Graph 1: Results of a simple example of optimizing the task of a business traveler using a genetic algorithm for 1000 generations. Finding the shortest path between 200 points is the task of finding the shortest distance between $200! = 8.8 \cdot 10^{377}$ permutations. The found path is not the shortest but it is found in real time.

2.1 Tabu search

Tabu search (TS) is a metaheuristic search method employing local search methods used for mathematical optimization. The method was created by Fred W. Glover in 1986 and formalized in 1989. The basic idea of TS is to penalize moves that take the solution into previously visited search spaces (also known as

tabu). TS does deterministically accept non-improving solutions in order to prevent getting stuck in local minimums. During the algorithm, the best solution is recorded, which we consider to be the resulting optimal solution. The disadvantage of this algorithm is that after a certain given number of interaction steps it returns to the local solution that has already occurred in the previous steps. This deficiency was solved by introducing the so-called *short-term* and *long-term memory*.

Short-term memory (tabu list) contains inverse transformations to the transformations used in previous interactions. If the transformation is contained in a tabu sheet, then it cannot be used to construct the neighborhood of the current solution. When the algorithm is initialized, the tabu sheet is empty, after each iteration a transformation is added to it, which provided a locally optimal solution. After the tabu list is filled, it is updated in each iteration (the length of the ban for all moves is reduced by one). An important parameter is the length of the tabu sheet. If the size is too small, then looping of the algorithm may occur. If the length is too large, then with a high probability we will miss local minima, which could be global minima. The search process can be significantly improved by using the so-called aspirational criteria. An aspirational criterion is a condition that allows ignoring a tabu constraint under certain circumstances (e.g., a forbidden move leads to a solution that is better than all solutions achieved so far).

Long-term memory works by disadvantaging (penalizing) those transformations which are not contained in the tabu list, but often occurred in the previous history of the algorithm. We distinguish two processes, intensification and diversification. Intensification strategies will focus on supporting "good" attributes in the search for solutions. Diversification strategies instead generate solutions involving attributes significantly different from those encountered in the previous search process. [6, 7, 8]

2.2 Penalty algorithm

The idea of using penalty functions in calculations was for the first time presented in [9]. Sometimes they have been used in optimization techniques. Several early approaches of evolutionary computations using the penalty functions were born in 1993–1995 [10]. Since genetic algorithms are generic search methods, most applications of genetic algorithms to constraint optimization problems have used the penalty function approach of handling constraints. The most frequently used and the simplest approach is penalization, in which the original fitness function $f(x)$ is supplemented with a penalty function. The objective function $F(x)$ expanded in this way has the form

$$F(x) = f(x) + \text{penalty}(x).$$

The penalty function approach involves a number of penalty parameters which must be set right in any problem to obtain feasible solutions. This dependency of genetic algorithms performance on the penalty parameters has led researchers to devise sophisticated penalty function approaches, such as multilevel penalty functions, dynamic penalty functions, and penalty functions involving temperature-based evolution of penalty parameters with repair operators.

We decided to make the optimization algorithm more efficient by introducing a dynamic penalty. This means that the amount of the penalty increases during the calculation depending on the number of generations. We have therefore introduced a variable into the algorithm which grows during the calculation, always after a certain number of generations (is multiplied to the second). The weight of such an increasing penalty increases with the increasing number of generations. [11, 12]

2.3 Simulated annealing

The basics of this method were first published in 1953 in an algorithm that simulated the cooling of the material in a hot bath. In the early 1980s, Kirkpatrick, Gelatt and Vecchi (1983) [13] and independently Vladimír Černý (1985, MFF UK in Bratisla-

va) [14] proposed that this type of simulation could be used to find admissible solutions of optimization problem in order to ensure convergence to an optimal solution. They also proposed its current name, simulated annealing (SA).

Physical Annealing is the process of heating up a material until it reaches an annealing temperature and then it is cooled down slowly in order to change the material to a desired structure. When the material is hot, the molecular structure is weaker and is more susceptible to change. When the material cools down, the molecular structure is harder and is less susceptible to change.

The acceptance criterion determines whether a new solution is accepted or rejected. The acceptance depends on the energy difference between the new solution and the current solution, as well as the current temperature. The classic acceptance criterion of SA comes from statistical mechanics, and it is based on the Boltzmann probability distribution. A system in thermal equilibrium at temperature t can be found in a state with energy E with a probability proportional to

$$P(\Delta E) = e^{\frac{-\Delta E}{k \cdot t}},$$

where k is the Boltzmann constant. Hence, at low temperatures, there is a small chance that the system is in a high-energy state. This plays a crucial role in SA because an increase in energy allows escape from local minima and find the global minimum.

Based on the Boltzmann distribution, the following algorithm defines the criterion for accepting an energy variation ΔE at temperature t . If we $t, \Delta E$ are the temperature and energy variation between new and current one candidate, than the pseudo-code for SA could be written in the next form.

```

if ( $\Delta E < 0$ ) then
    true;
else
     $r =$  random number  $\in [0,1)$ ;
    if  $r < \exp(-\Delta E / (k \cdot t))$  then
        true;
    else
        false;
    end
end

```

A candidate solution with lower energy is always accepted. Conversely, a candidate solution with higher energy is accepted randomly with probability $P(\Delta E) = \exp(-\Delta E / k \cdot t)$. The latter case can be implemented by comparing the probability with a random value generated in the range $[0, 1)$. The temperature schedule determines how the temperature of the system changes over time. In the beginning, the temperature is high so that the algorithm can explore a wide range of solutions, even if they are worse than the current solution. As the iterations increase, the temperature gradually decreases, so the algorithm becomes more selective and accepts better solutions with higher probability. A simple scheduling can be obtained by dividing the current temperature by a factor $0 < \alpha < 1$.

And so, as a final improvement, we supplemented the algorithm with a decision to accept a new individual into the next generation based on the principle of simulated annealing. The mutation operation is of more fundamental importance to the calculation process, we decided to apply this procedure to it. And so that the quality (determined by the objective function) of each mutated individual is compared with the quality of its predecessor. If the quality of the mutated is better than the quality of the predecessor, the mutated advances to the next generation. If not, it advances

to the next generation with a probability given by the principle of simulated annealing. [15, 16]

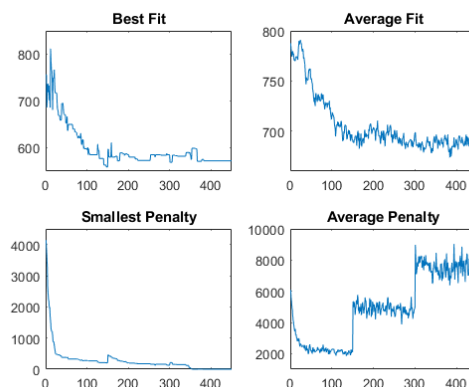
3 Results

We simulated the algorithm to run a production schedule optimization with a dynamic penalty and a decision operation using simulated annealing after mutation for 50 entities with predefined move times between entities. The termination of the simulation occurs if the smallest dynamic penalty is sufficiently close to zero, which means that the found approximate solution is not an approximation of the local solution. The entire simulation was programmed in the Matlab environment.

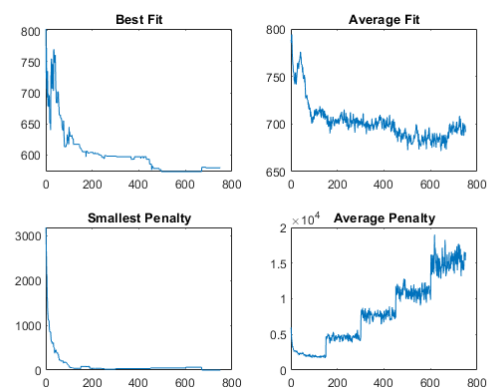
Of course, we could explore countless cases with different input conditions or different borderline situations, but for reasons of capacity we will limit ourselves to a minimalistic abridgement for one case of input conditions. The results are in the following graphs (Graphs 2-4).

4 Discussion

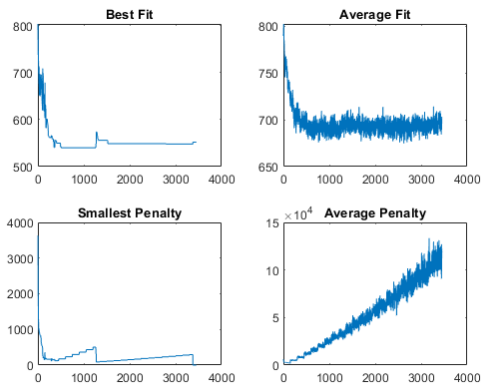
The first and second attempts decrease quite clearly, although the second attempt shows a strong influence of the increasing penalty caused by the penalty of simulated annealing. This also caused a higher number of generations of the genetic algorithm simulation. But the third case is somewhat borderline, as the penalty grew exponentially. However, this was apparently caused by a sharp drop in the fit value at the beginning of the simulation, i.e. the "annealing temperature", which subsequently caused a sharp increase in the penalty. Even this did not cause the divergence of the algorithm, which stopped after a higher number of generations, but with an acceptable value of the fit function.



Graph 2: Simulation (first attempt) results for 50 randomly selected flow-shop operations with predefined times between operations, with a population size of 200.



Graph 3: Simulation (second attempt) results for 50 randomly selected flow-shop operations with predefined times between operations, with a population size of 200.



Graph 4: Simulation (third attempt) results for 50 randomly selected flow-shop operations with predefined times between operations, with a population size of 200.

5 Conclusion

Genetic algorithms are widely used in practice, not only technical and economic, but also, as we can see, in production processes. As a method for solving both constrained and unconstrained optimization problems that is based on natural selection, the process that drives bio-logical evolution can be the genetic algorithm apply the genetic algorithm to solve a variety of optimization problems that are not well suited for standard optimization algorithms, including problems in which the objective function is discontinuous, nondifferentiable, stochastic, or highly nonlinear. All three mentioned ways of improving this algorithm not only speed up the algorithm but also increase its reliability.

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Primary Paper Section: B

Secondary Paper Section: BB, BC

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

PORK QUALITY IN CENTRAL EUROPE

^aTEREZA MATASOVÁ, ^bYELYZAVETA APANOVYCH,
^cLIBUŠE TURINSKÁ

^{a,b}*Institute of Technology and Business in Ceske Budejovice,
Okružní 517, ^cPan-European University in Bratislava,
Tomášikova 20*

Email: ^amatasova@mail.vstecb.cz, ^bapanovych@mail.vstecb.cz,
^cturinska@mail.vstecb.cz

Abstract: The article aims to assess meat quality in Central Europe between 2005 and 2022. Using descriptive statistics, correlation and a student's paired t-test, we found a substantial quantity decline but a tremendous quality increase in the monitored categories. Meat quality mostly suffered at the beginning of the period, witnessing an enormous improvement later on. Our article confines to annual pork value, lacking an analysis of weekly statements and SEU quality of the SEUROP classification.

Keywords: quality, pork, live weight, correlation, t test.

1 Introduction

The meat industry is essential for agricultural and food production, supplementing incomes in less-developed regional economies (Benus, 2019). The sector also relates to the food and beverage industry, the most significant energy consumer and return on sales maker in the European Union (Iten et al., 2021).

The meat industry is essential for agricultural and food production, supplementing incomes in less-developed regional economies (Benus, 2019). The sector also relates to the food and beverage industry, the most significant energy consumer and return on sales maker in the European Union (Iten et al., 2021). People know about potential hazards related to meat manufacturing as they consume the commodity daily (Bateman et al., 2019). Clare et al. (2022) suggest reducing the risks from processing red meat to recover human and planetary health and appease eco-active politicians. Humane slaughtering involves stunning that lasts until death, reducing the pain and fear throughout procedures (Coelho et al., 2022). Slaughtering and processing of poultry may occur in a slaughterhouse or farm in three phases (Saxmose et al., 2019). Increased chicken meat consumption raises production volumes (Copley and Wiedemann, 2023). Piewthongngam et al. (2019) argue that pork meat processing resembles disassembly planning, as a planner must decide on the pig size and the amount for a slaughterhouse and meat quantity and size needed to meet orders. The slaughtering procedure and change to dead meat are essential because its taste depends on the animal's treatment during the slaughter (Hultgren et al., 2020; Davydova & Davydov, 2021). A short distance to the abattoir will relieve stress from transportation (Hultgren et al., 2020).

People consume pork, rich in proteins, fat and other natural substances, almost daily (Tinh et al., 2020), (Milczarek et al., 2019). The demand for pork meat relies heavily on extensive swine breeding (Kovacikova et al., 2022).

In some countries, enterprises may suffer tremendous economic losses, as slaughtering animals relates to religious ceremonies and rituals (Mroczek, 2021). A slaughter may also involve a charitable act to produce leather clothes (Strawn, 2022). The church, bar trade union coalitions and non-government organizations have long been trying to mobilize national media and politicians to impose regulations on the meat industry (Ban et al., 2022).

The article aims to assess the quality development of pork meat in Central Europe between 2005 and 2022.

The meat quality of carcasses determines the price and assesses the effectiveness of adopted procedures. Muscle mass percentage of total slaughter weight per piece is an essential factor for the assessment. The per cent limits observe the objective criteria of

the European Commission (SEUROP). We formulated the following research questions:

RQ1: How does meat quality change according to the criteria over the monitored period?

Materials, including pork meat, face enormous pressure and requirements for continuous quality increase.

RQ2: Can we notice accelerating trends in the meat quality of carcasses over the monitored period?

Although meat production must maintain quality, separate pieces may lose substantial waste body parts useful for further processing.

RQ3: Does the quantity of slaughtered animals indicate a bigger difference between live weight and carcasses?

2 Literary research

Conventional methods of calculating value changes involve descriptive statistics. Subanji et al. (2021) assess vast differences in creative statistical models of students based on sex, revealing that descriptive statistical activities show no sharp divergencies. Descriptive statistics is the first step for data analysis. Scholars do statistical inference tests after descriptive statistics to have a reliable dataset (Mondal et al., 2022). Mirsha et al. (2019) argue that descriptive statistics is integral for a professional study, characterizing research data and specifying the dataset. Descriptive statistics also include a median minimizing the sum of distances between all elements in the sample (Panov & Savvateev, 2020).

A rough estimate of the least squares is essential for working with inaccurate data and effectively solving linear regression (Shi et al., 2022). These models are sensitive to distant values (Kundu et al., 2023), relying heavily on mixed methods of the least squares to estimate linear parameters (Zheng and Yang, 2019). This estimate can be inaccurate unless including variables outside the model (Gatto and Marcuzzi, 2020). Random sampling is the simplest way of data acquisition where there are problems with the least squares (Guo et al., 2020). Xie et al. (2022) argue that the partial least squares regression is applicable even if the variables far exceed the samples. The simulations of two existing datasets show that the technique is efficient and robust. Okwuashi et al. (2020) compare the partial least squares regression with the conventional model, revealing that the former makes the cut.

We commonly use the Pearson correlation to quantify the dependence between the time series pairs. If dependent and time-autocorrelated, we reduce them. Afyouni et al. (2019) suggest a practical method involving a different autocorrelation and immediate and delayed correlation in each time series. Jaganathan and Hassibi (2019) deal with reconstructing two signals from autocorrelated measurements. Kiran et al. (2019) point to different meat quality and indicate essential proteins relative to the meat structure and pre-slaughter stress of sheep slaughtered with or without electronarcosis. Based on these methods, Sun et al. (2023) examine favorable conditions for extracting the rotation mode and speed. We used time series to explore whether the exposition time makes the analyses more accurate.

We use multiple methods to examine the datasets and identify possible repeated cycles. Leng and Zhu (2020) argue that regression is often applicable for measuring a linear relationship between two inaccurate variables, reliably assessing the influence of one or more independent variables on the outcome. The drawbacks are inaccuracies when using a small dataset (Chukhrova and Johannssen, 2019) or datasets with remote values (Panagopoulos et al., 2019). Various graphs suggest

regression outcomes (Ovedele, 2021). Xu and Huang (2020) suggest maximal correlation regression, a new approach to regression analysis. We commonly combine various analyses and methods to achieve hybrid and upgraded outputs, e.g. a t-test and ANOVA, widely used in experimental studies (Liu and Wang, 2021). Mishra et al. (2019) apply the analysis of variance and covariance for testing, although they use a t-test to compare two means. Sarkar et al. (2021) employ the Student's t-test for testing normally distributed means with an unknown population correlation and variances. The one-way ANOVA explores the influence of a factor on the variable (Traneva et al., 2022). The results of the ANOVA are valid upon meeting all requirements for the model (Pineda Becerril et al., 2019). Alassaf and Qamar (2022) explore the one-way ANOVA for selecting features to reduce the number of elements when classifying tweeted opinions. Xavier de Carvalho et al. (2023) examine and assess a preliminary analysis of variance when interpreting experimental data. Although the t-test is the most used statistical test in all scientific publications (Cahusac and Mansour, 2022), it may sometimes be misleading (Novak, 2022).

Qualitative content analysis is applicable in small and simple experiments (Vears and Gillam, 2022). Boettger and Friess (2020) use a quantitative content analysis on 672 journal articles, coding them according to the required variables. Bouko et al. (2021) use content analysis to measure citizens' reactions to Brexit, analyzing the strength and polarity of the opinions. The textual analysis based on coding schemes is suitable for processing secondary data (Myers et al., 2019).

We use the content analysis of data and documents for the secondary data collection, which gives us answers to all research questions. The first RQ relies on descriptive statistics, the second involves correlation, and the third depends on the student's paired t-test for data processing.

3 Data and methods

Our research questions, except for the first, require hypotheses. Their p-value is set to 0.05 and are as follows:

RQ2: Can we notice accelerating trends in the meat quality of carcasses over the monitored period?

H0a: The carcass does not see a quality increase over the monitored period.

RQ3: Does the quantity of slaughtered animals indicate a bigger difference between live weight and carcass?

H0b: The increased quantity of slaughtered animals with the difference between live weight and carcass.

H0c: The difference between the pork live weight and carcass is increasingly bigger.

3.1 Data

The datasets and information on percentage meat quality, average cut yield, quantity of slaughtered pigs, quality categories and average live weight and carcass are available on the internet portal of the State Agricultural Intervention Fund in the News section and 'Tržní informační systém' in 'tržní zprávy' (szif.cz, 2023 – Czech version). We will select the bulletin called 'Beef and pork'. The webpage contains the year for which we want to display PDF files with relevant data in the upper right corner. The bulletins come out biweekly and fall into quarters. The information in the files observes weekly reports, including two periods in each biweekly. The research questions reflect a total annual overview of values issued as biweekly expansions at the beginning of the following year.

We respect only the categories with the highest representation, the SEU group, regarding the overall quality ratio of the SEUROP classification. All hypotheses will mimic the classes. The remaining groups indicate an average amount only of 3.5%, containing detailed and confidential information. The suggested prices do not include GNP or shipping costs.

We will transfer the collected data to MS Excel 2019 for further processing. All monitored periods involve columns with corresponding values for a formal and logical preparation for a follow-up manipulation and application. This data collection method will apply to all research questions and related hypotheses.

3.2 Methods

Descriptive analysis will answer the first research question, focusing on average, sum, min and max ratios. The method will summarize all values from all quality categories in the SUMA Excel, comparing results from each class for each year. The findings will show which quality categories were mass-produced in which period, compiling the outcomes into a graph.

The correlation will respond to the second question, using the Pearson correlation coefficient to determine the linear relationship between quality and production. The coefficient's symbol is r in the interval between -1 and 1. If r equals zero, there is no connection between the variables. Its closeness to 1 shows a positive linear correlation, indicating a growth of both quantities. The proximity to -1 implies a negative linear relationship, displaying a reverse effect.

The coefficient is calculated as follows:

$$r = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sqrt{\sum(x - \bar{x})^2 \sum(y - \bar{y})^2}}$$

Where:

r is a resultant correlation coefficient,

x is the first variable,

y is the second variable,

\bar{x} a \bar{y} are averages of the observed values

The resultant coefficient is not always accurate, so we must precisely specify the limits of the resulting values as follows:

Table 1 The definition of the correlation

	from	to
Very weak correlation	0.01; -0.01	0.20; -0.20
Weak correlation	0.20; -0.20	0.40; -0.40
Average correlation	0.40; -0.40	0.60; -0.60
Strong correlation	0.60; -0.60	0.80; -0.80
Very strong correlation	0.80; -0.80	0.99; -0.99

Source: Author.

The student's two-sample paired t-test will answer the third research question, using MS Excel for the data analysis. We will choose the Paired Two-Sample t-Test for Means and select both datasets with source data necessary for the calculation. We will input Alfa: 0.05 into the table and choose an output area. Then, we only click on 'confirm'.

The second possibility directly involves the t-test, including required cells with Matrix 1 and 2 in the first two and the tail (1) in the third place. The last, fourth place, picks the 1-paired test. Upon confirming, the test will generate a value informing whether the difference between the observed pairs is statistically significant.

We assume an increase in the overall average pork quality over the monitored period, arguing that the number of slaughtered pigs does not affect the difference between the live weight and carcass.

4 Results

Now, we will verify and answer the research questions and related hypotheses. The summarized annual values, foundational quality indicators and selected S, E and U categories indicate substantial percentage and value changes. The following table suggests a detailed overview of the most significant alterations over the monitored period.

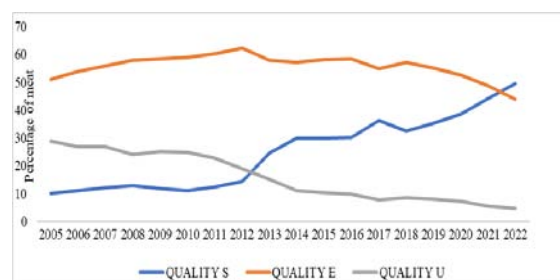
Table 2 Changes in quality

	MINIMUM		MAXIMUM		AVERAGE
S Category	10	2005	49.6	2022	24.82
E Category	44	2022	62.4	2012	55.74
U Category	4,7	2022	29	2005	15.95

Source: Author, based on www.szif.cz.

The average cut yields show increasing quality standards in the categories over the years, indicating the highest value of 55.74 in the E Quality, which is more than half of the production. The mean values peaked in 2012. The S Class topped U Quality between 2012 and 2013, showing a steady trend. S eclipsed E Class between 2021 and 2022, displaying the lowest quality of cut yields in all categories in 2005. The second research question also provides a graphical depiction of our findings.

Graph 1 Individual quality categories over the monitored period



Source: Author based on www.szif.cz

Although the numbers of slaughtered animals show a declining trend over the period, pork quality increases, which is visible in all categories. The correlation coefficient between average cut yields according to the SEU and the total carcasses indicates negative values of -0.8921873 , implying a strong negative linear correlation. We can then reject the $H0a$ and accept the alternative, confirming a carcass quality improvement over the monitored period.

The average annual data suggest a 25-kg difference between the live weight and carcass until 2015. The weight increases from 2016 to 2020, topping 28 kg, indicating values higher by 3 kg. We confirm these facts by the student's paired t-test with a result of $1.06332E-13$, rejecting $H0b$.

The average cut yield of slaughtered animals grows from 56.24% to 59.75% over the monitored period. The student's t-test suggests a difference of $2.23302E-28$ between the yields of live weight and carcass, indicating no statistically significant discrepancy between the carcass percentage and the mass of slaughtered pigs over the period. We may reject $H0c$, suggesting a growing disparity between the live weight and carcasses.

5 Discussion

Based on the results, we can answer the research questions.

RQ1: How does meat quality change according to the criteria over the monitored period?

Our findings suggest a substantial quality increase according to the criteria over the period, indicating the lowest quality in the U category in the early years. The last observed year, 2022, witnessed the finest pork quality. The quality of the S and the U categories overlaps between 2012 and 2013, stretching out to E class between 2021 and 2022. Subanji et al. (2021) used descriptive statistics to focus on differences between students according to sex, revealing no statistically significant dissimilarities. Our study proves, on the contrary, considerable disparities in the values over the monitored period.

RQ2: Can we notice accelerating trends in the meat quality of carcasses over the monitored period?

The findings from the previous chapter confirm the alternative hypothesis of a quality increase over the period, despite the diminishing numbers of slaughtered animals. Given the contrast between the quality improvement and lessening quantities, the correlation is -0.892187 , indicating a negative relationship between the observed variables. Kiran et al. (2019) employed the same method for testing the proportion of essential proteins in different meat quality structures.

RQ3: Does the quantity of slaughtered animals indicate a bigger difference between live weight and carcass?

The number of slaughtered animals decreased over the monitored period, indicating a 25-kg difference between the live weight and carcass until 2015. The following years saw a weight difference grow by three kilograms. The student's t-test equaled $1.06332E-13$, rejecting the second zero hypothesis. The third hypothesis concerns increasing dissimilarities in the cut yield. The student's t-test for the conjecture was $2.23302E-28$, suggesting no statistically significant variance between the cut yield percentage and weight variations (live weight and carcass) of slaughtered pigs. Based on these findings, we dismiss the third assumption. Cahusace and Mansour (2022) used the t-test in their experiments.

6 Conclusion

Meat involves essential nutrients, requiring high-quality production. We have recently paid increased attention to quality criteria, imposing safety measures on food processing. The article aimed to assess pork quality in Central Europe between 2005 and 2022. Based on annual reports from a publicly available database, we found dwindling pork production quantities but a tremendous quality improvement in the tested categories over the monitored period. We used descriptive statistics, the Pearson correlation coefficient and the student's paired t-test to answer the research questions and confirm or reject related hypotheses. Our findings proved alternative assumptions, dismissing the formulated theories. The study revealed gradual beneficial qualitative changes in pork carcasses, leaving the difference between the live weight and carcass intact. Our analysis illustrates and evaluates the full development of pork quality in the Czech Republic, indicating an enormous year-to-year quality increase over the period. The article may also be seminal to people involved in the meat industry or ordinary consumers interested in the ingredients. The study lacks a longer monitored period, confinement to the Czech Republic and annual values and includes only pork in SEU categories. Further research may focus on assessing beef or chicken, conducting in-depth analyses of weekly reports in another country and for a longer time. Follow-up surveys may also involve beef and pork export/import ratios over a period or exploring changes in the production and consumption of various meat types.

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I INFORMATICS

IN INFORMATICS

THE IMPACT OF COVID-19 ON THE DEVELOPMENT AND APPLICATION OF NEW TECHNOLOGIES IN ASSISTED RETAIL IN THE CZECH REPUBLIC

^aJAKUB MACHALICKÝ

*Mendel University in Brno, Zemědělská 1, Brno, Czech republic
email: ^axmachali@mendelu.cz*

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Abstract: This study investigates the transformative effect of the COVID-19 pandemic on the development and implementation of advanced technologies in the Czech Republic's assisted retail sector. The pandemic accelerated digital transformation across industries, and retail was no exception. The enforced changes in shopping habits and safety measures have led to a surge in the demand for technology-driven solutions in retail, pushing businesses towards innovation to ensure continuity and resilience. The paper analyzes both qualitative and quantitative data gathered from various assisted retail businesses in the Czech Republic. The research employs a mixed-method approach, incorporating case studies, surveys, and statistical analysis to provide comprehensive insights into the swift technological transformations. The findings indicate a significant increase in the adoption of technologies such as contactless payments, augmented reality (AR), artificial intelligence (AI), and machine learning (ML) in retail operations. It further reveals the increased use of e-commerce platforms, digital marketing strategies, and mobile applications to promote contactless shopping. A notable aspect of the study is the rise of voice-assisted shopping, demonstrating a technological shift towards more personalized and efficient customer service. The implications of these findings suggest that the pandemic-induced circumstances have revolutionized retail technology in the Czech Republic. It also hints at the potential for other industries to learn from the strategies deployed in this sector. The study concludes by emphasizing the need for further research to assess the sustainability and long-term impact of these new technologies post-pandemic.

Keywords: assisted retail, covid-19, Czechia, digitization, sales motivation

1. Introduction

The COVID-19 pandemic has ushered in unprecedented changes across all sectors of global economies. These changes have been especially apparent in the realm of retail, where the outbreak has fundamentally altered the traditional retail environment, necessitating rapid adaptations and the implementation of new technologies to facilitate retail operations under novel and challenging circumstances. This paper focuses on these shifts in the context of the Czech Republic, a country that has seen a remarkable transition towards tech-enabled, assisted retail in response to the pandemic. The country's retail sector has historically relied heavily on in-person transactions, with only a modest penetration of e-commerce before the pandemic. However, the spread of COVID-19 and the subsequent containment measures have swiftly expedited the digital transition, fostering the development and uptake of a myriad of innovative retail technologies. The aim of this study is to analyse the transformation that the Czech retail sector has undergone, identify the key technologies that have emerged or gained prominence during this period, and evaluate their impacts on both businesses and consumers. We take a multi-faceted approach in our examination, considering aspects such as shifts in consumer behaviour, changes in supply chain dynamics, the rise of contactless shopping solutions, and the broader macroeconomic effects of these changes. Our findings not only contribute to the understanding of how the retail industry in the Czech Republic has adapted to the current crisis, but also shed light on the possible future trajectory of this sector post-pandemic. As such, this research offers valuable insights for industry stakeholders, policymakers, and academics interested in the intersection of retail, technology, and global health crises.

2. Materials and methods

In this paper we work with two main sources of data. First is existing article and studies which mainly focuses on global markets or American market to analyse what are trends around the world. Second source of data is own research done by eyeball observation of current situation on the floor of malls and other types of shopping facilities. Part of this eyeball observation is also understanding what modern trends are publicly presented using key companies' key communication channels, these channel are as follows.

In-Store Communication: This traditional form of communication remains crucial in retail. It includes signage, point-of-sale displays, and in-person communication from staff members (Levi, 2018). **Email:** Despite the rise of many new digital communication channels, email remains a major tool for retailers. It allows for personalized communication and is effective for both acquisition and retention strategies (Kumar, 2018). **Website and Mobile Apps:** Retailers' websites and mobile apps serve as vital points of contact with customers, providing product information, facilitating transactions, and offering customer service (Molnár, 2021). **Social Media:** Platforms like Facebook, Instagram, Twitter, and Pinterest are used by retailers to engage with customers, promote products, and handle customer service issues. Social media also plays a key role in influencing purchasing decisions (Hajli, 2014). **SMS and Push Notifications:** These direct and instant communication methods are increasingly being used by retailers to reach customers with timely, personalized messages (Barwise, 2002). **Online Marketplaces:** Platforms like Amazon and eBay are essential channels for retailers to reach a larger audience, especially for those without a strong standalone e-commerce presence (Zhu, 2018). **Print and Broadcast Media:** Traditional media channels, like newspapers, magazines, television, and radio, still play a role in retail communication, particularly for certain demographic segments and types of products (Jaremen, 2016). Expectation is that if company uses some kind of modern technology, it will be presented somehow.

2.1. Key czech assisted retail companies

Assisted retail, also known as guided selling or assisted selling, refers to a sales strategy where sales associates, through the use of technology or personal expertise, guide customers in their purchasing decisions. This can happen in a physical store or online, with the aim of providing a personalized shopping experience, enhancing customer satisfaction, and ultimately driving sales. In a physical store, this might take the form of a knowledgeable salesperson providing expert advice to a customer, using their expertise to suggest products that best meet the customer's needs or preferences. The assistance might also come in the form of interactive product demonstrations, personalized product recommendations, or even augmented reality experiences to help customers visualize products. In the online world, assisted retail often takes the form of technologies such as chatbots, AI-powered product recommendation systems, virtual try-on tools, and interactive quizzes or questionnaires that guide the customer to the most suitable products based on their answers. In the context of COVID-19, assisted retail technologies have become particularly important, as they help retailers maintain a high level of customer service even when face-to-face interactions are limited or not possible. For example, live chat and video chat tools allow sales associates to offer real-time advice to online customers, much as they would in a physical store. Similarly, AI-powered solutions can analyse a customer's browsing behaviour to recommend products they might like, effectively replicating the role of a helpful sales associate. By offering personalized, expert advice, assisted retail strategies aim to make the shopping experience easier and more enjoyable for customers, while also boosting the retailer's sales and customer loyalty. In this paper assisted retail is focused on selling of services, especially long-term services such as banking products, insurance products and telecommunications. For this reason top nine companies defined by number of clients by the end of 2022 are considered. Overview of this companies is enlisted in table below. Three biggest examples from each industry are selected.

Tab 1: Top nine companies in Czech market in selected industries.

Company	Industry	Clients
Česká spořitelna	banking	4,493 mil.
Komerční banka	banking	4,225 mil.
Československá obchodní banka	banking	2,251 mil.
T-Mobile	telecommunications	6,423 mil.
O2	telecommunications	5,671 mil.
Vodafone	telecommunications	3,989 mil.
Česká pojišťovna a.s.	insurance	4 mil.
Kooperativa pojišťovna, a.s.	insurance	2,5 mil.
Allianz pojišťovna, a.s.	insurance	1,2 mil.

Source: Annual reports 2022.

2.2. World wide used modern technologies

Technologies are commonly divided into sections by common interest (stakeholder). First basic category is Customer facing innovation, followed by employee faced innovation and last one which does not have to be obvious is supplier or internal innovation.

Phygital

'Phygital' in retail encapsulates experiences where physical and digital elements are seamlessly integrated (Pantano, 2020). With consumers increasingly seeking convenience, customization, and engaging shopping experiences, retailers are adopting phygital strategies to create differentiated value propositions. The phygital retail journey starts with omnichannel strategies that allow businesses to engage customers across various touchpoints. However, phygital goes beyond omnichannel by not just providing multiple channels, but merging these channels into a unified, enhanced shopping experience (Verhoef, 2015). AR/VR plays a crucial role in phygital retail. AR allows customers to visualize products in their environment before making a purchase (Rese, 2014), while VR can create immersive, virtual shopping experiences that closely mimic physical stores (Grewal, Roggeveen, 2017). IoT contributes to the phygital space by creating interconnected experiences. Smart fitting rooms, connected shelves, and beacons provide personalized and interactive experiences to customers (Kumar, 2016). AI-powered solutions such as chatbots, recommendation engines, and predictive analytics contribute to the personalization and efficiency of the phygital experience (Huang, 2020). The future of retail lies in the innovative integration of digital technology within physical spaces, making shopping an engaging and immersive experience. Retailers who will invest in creating holistic phygital experiences are more likely to win customer loyalty in the increasingly competitive market (Piotrowicz, 2014). The phygital approach is transforming retail, creating immersive, personalized, and convenient shopping experiences. As technology advances, retailers must continuously evolve and adopt innovative phygital strategies to stay competitive and meet consumer expectations.

The metaverse

The concept of the metaverse is not a new phenomenon. It has been in literature and pop culture for years. However, with technological advancements in AI, VR/AR, and blockchain technologies, the realization of the metaverse in retail is becoming increasingly feasible and attractive. This article explores how the metaverse can reshape the retail industry, offering unprecedented immersive and interactive experiences. We will delve into practical use cases, benefits, and challenges, whilst referencing relevant research and studies. With technology constantly evolving, the retail industry has seen

significant transformations over the years. From brick-and-mortar shops to ecommerce, and now to the metaverse, retail continuously explores new ways to engage with customers (Rigby, 2011). The metaverse, a collective virtual shared space created by the convergence of physical and virtual reality, is seen as the next frontier for retail (Kinsella, 2022). This paper explores how this digital universe can transform the retail landscape. The Metaverse in Retail in few Practical Use Cases: Virtual Showrooms and Stores: In a metaverse, retailers can design virtual stores that mirror their physical counterparts or create unique experiences impossible to replicate in reality (Gucci, 2021). Customers can explore these stores using avatars, interact with products, and make purchases. An example is the "NikeLand" in the Roblox metaverse, where users can try on and purchase virtual footwear (Nike, 2023). Immersive Product Demonstrations: Product demonstrations can be more engaging in a virtual environment, particularly for products such as furniture, fashion, and electronics (Ikea, 2022). Customers can interact with the products in a virtual space, experiencing their use in a realistic context before making a purchase. Social Shopping Experiences: The metaverse enables social interactions akin to shopping with friends in the physical world (He, 2020). Users can meet in virtual stores, browse products together, and exchange opinions, enhancing the social aspect of shopping. AI-Driven Personalization: Retailers can use AI algorithms to track user behaviour within the metaverse and offer personalized recommendations (Huang, 2023). This goes beyond online cookies, as it can include understanding how users interact with products in the virtual environment. There is a lot of benefits of the Metaverse in Retail Enhanced Customer Engagement. The metaverse offers a richer, more immersive experience compared to traditional online shopping. It allows consumers to interact with products and brands in novel ways, enhancing engagement and brand loyalty (Pantano, 2021). Increased Reach and Accessibility: Virtual stores in the metaverse can be accessed from anywhere in the world, removing geographical limitations of physical stores. This can potentially open up new markets for retailers (Moeslein, 2022). Innovation and Differentiation: Retailers who adopt metaverse technologies can differentiate themselves from competitors. Innovative use of the metaverse can be a unique selling point, attracting consumers seeking novel shopping experiences (Porter, 2014). With all the benefits, there are challenges and limitations. Despite the promising potential, the adoption of the metaverse in retail is not without challenges. Technological Limitations: While VR/AR technology has advanced considerably, creating a truly immersive, seamless metaverse is still a technical challenge (Schroeder, 2016). Furthermore, consumer adoption of necessary hardware like VR headsets is still relatively low. Privacy and Security Concerns: The metaverse involves gathering large amounts of data about user behaviour and interactions. This raises significant privacy and security concerns that need to be addressed (DeNardis, 2020). The metaverse offers an exciting new paradigm for retail, promising unprecedented interactive and immersive experiences. While there are challenges to its implementation, with the pace of technological advancements and increasing consumer acceptance of virtual experiences, the metaverse is set to become an integral part of the retail industry's future.

Hyper-personalization

Next prominent trend is hyper-personalization, which is the use of data to provide highly individualized interactions, products, and services to customers (Tam, 2006). In the realm of assisted retail, where digital and physical shopping experiences merge, hyper-personalization can lead to a multitude of benefits, including increased customer engagement and loyalty, and consequently higher sales (Manthiou, 2020). Some use cases includes personalized shopping assistants: Assisted retail often involves the use of digital assistants to guide customers through the shopping process. Hyper-personalization can enable these assistants to provide recommendations based on past purchases, browsing behaviour, and customer preferences (Chu, 2020). Tailored Promotions: Retailers can use customer data to offer hyper-personalized promotions, targeting individuals with offers that are most relevant to them, enhancing the likelihood of

purchase (Sahni, 2018). Individualized In-Store Experience: With the use of IoT devices and smartphone apps, retailers can personalize the in-store experience. Customers can receive tailored product suggestions and locate items in-store based on their shopping list (Want, 2015). Benefits of using hyper-personalisation involves increased Customer Satisfaction: Hyper-personalization enables retailers to cater to the unique needs and preferences of each customer, which can lead to higher satisfaction levels and customer loyalty (Yi, 2013). Improved Sales: Hyper-personalized interactions can increase the conversion rate by presenting customers with relevant product suggestions and promotions, leading to increased sales (Cho, 2012). Enhanced Customer Retention: By offering a tailored shopping experience, retailers can increase customer retention, as satisfied customers are more likely to return (Verhoef, 2007). Despite the potential benefits, the implementation of hyper-personalization in assisted retail presents challenges. Privacy Concerns: The use of customer data raises significant privacy concerns. Retailers must ensure they comply with relevant data protection laws and maintain transparency with customers about how their data is used (Martin, 2017). Data Quality: The effectiveness of hyper-personalization depends on the quality of the data collected. Poor data quality can lead to irrelevant suggestions, damaging the customer experience (Wang, 1996). Retailers must implement robust data management practices to ensure data accuracy and relevancy. Hyper-personalization holds great promise in the realm of assisted retail. By delivering tailored experiences, retailers can enhance customer satisfaction, increase sales, and improve customer retention. While challenges exist, particularly around data privacy and quality, careful implementation and robust data management can help realize the potential of hyper-personalization in transforming the retail landscape.

Web3

Web3 represents a shift from centralized, server-based systems to decentralized, peer-to-peer networks (Tapscott, 2016). Blockchain, a cornerstone technology of Web3, is a decentralized ledger that facilitates secure, transparent, and tamper-resistant transactions (Nakamoto, 2008). In assisted retail, which aims to blend online and offline shopping experiences, Web3 can unlock new possibilities for customer engagement, data management, and personalized shopping (Verhoef, 2015). Web3 can be used as Decentralized Customer Data Management: Blockchain technology can create a secure, decentralized database of customer data. This allows for data self-sovereignty, where customers control their data and can grant permissions to retailers to access it (Zyskind, 2015). Tokenized Loyalty Programs: Retailers can leverage blockchain to create tokenized loyalty programs, enhancing customer engagement. Customers can earn and trade tokens across different retailers, improving the flexibility and attractiveness of these programs (Kumar, 2016). Authenticated Product Information: Blockchain can be used to authenticate product information, ensuring transparency and reducing counterfeiting. Customers can verify the origins, ingredients, or production process of products, fostering trust (Tian, 2016). Enhanced Customer Trust: Web3 technologies, like blockchain, promote transparency, data security, and customer control over personal data, which can enhance trust in retail interactions (Ølnes, 2017). Improved Customer Engagement: Tokenized loyalty programs and authenticated product information can lead to more engaged customers, who are likely to feel valued and trust the authenticity of products (Demirkan, 2018). Efficient Data Management: Decentralized data management can streamline data handling processes, reducing inefficiencies associated with centralized systems and enhancing data privacy (Mougayar, 2016). Despite the potential benefits, the application of Web3 in assisted retail also presents challenges. Technical Complexity: The implementation of blockchain and other Web3 technologies requires technical expertise, which may be a barrier for some retailers (Drescher, 2017). Regulatory Concerns: Given the nascent state of Web3 technologies, regulatory frameworks are still evolving, creating uncertainty for businesses (Tapscott, 2018). Adoption and Acceptance: The success of Web3 in retail

is also dependent on customer adoption and acceptance of these technologies, which may take time and education (Atzori, 2015). Web3 holds great promise in revolutionizing the retail industry, providing new mechanisms for customer engagement, data management, and trust-building. Despite the challenges, retailers that adapt and innovate using Web3 technologies could gain a competitive edge, shaping the future of the retail experience.

Chatbots

In the evolving retail landscape, businesses continually seek innovative ways to engage with customers and drive sales. Among these, chatbots, interactive software platforms that simulate human conversation, have emerged as powerful tools for assisted retail (Brandtzaeg, 2017). By facilitating a seamless blend of online and offline shopping experiences, chatbots can personalize interactions, streamline operations, and enhance customer service (Ghose, 2020). Personal Shopping Assistants: AI-powered chatbots can serve as personal shopping assistants, offering product recommendations based on user behaviour, past purchases, and preferences (Davenport, 2020). Customer Service: Chatbots can provide instant, round-the-clock customer support, answering common queries, providing information about products or services, and resolving complaints (Gurman, 2018). Sales and Marketing: Chatbots can be programmed to upsell and cross-sell products, notify customers of promotions, and facilitate transactions, thereby driving sales (Dai, 2019). Of course there are benefits such as Improved Customer Engagement: By offering personalized recommendations and immediate responses, chatbots can engage customers more effectively, fostering a positive shopping experience (Huang, 2018). Operational Efficiency: Automating repetitive tasks like responding to common customer queries allows retailers to allocate resources more efficiently (Marinova, 2017). Enhanced Sales: By assisting in the purchase process and offering tailored product suggestions, chatbots can potentially increase conversion rates and boost sales (Li, 2014). While chatbots present significant opportunities for assisted retail, they also pose challenges. Customer Acceptance: Despite advancements in AI, some customers may prefer human interaction over chatbots (Lu, 2019). To mitigate this, retailers can focus on improving the sophistication of chatbots and maintaining an option for human assistance. Data Privacy: The use of chatbots involves collecting and analysing customer data, raising privacy concerns. Retailers must comply with data protection regulations and be transparent with customers about their data usage policies (Martin, 2017). Technical Limitations: Although AI has come a long way, chatbots may still struggle to understand complex queries or exhibit empathy. Continuous technological advancements and training are crucial to address these limitations (Zhou, 2012). Chatbots, by bridging the gap between digital and physical retail spaces, present a compelling opportunity for businesses to enhance customer engagement, improve operational efficiency, and drive sales. Despite certain challenges, strategic implementation of chatbots can contribute significantly to the evolution of the retail landscape.

Remote assistance

The retail sector has undergone significant digital transformation in recent years, a trend that has been expedited by the COVID-19 pandemic. Assisted retail, combining online and offline experiences, has been particularly affected, with remote assistance emerging as a crucial facet (Pantano, 2020). Leveraging technologies like Augmented Reality (AR), Virtual Reality (VR), and AI-powered chatbots, remote assistance offers a digitally-enhanced, personalized shopping experience, irrespective of geographical constraints (Huang, 2020). The pandemic has caused unprecedented disruption to retail, necessitating an immediate shift towards digital platforms. Remote assistance has become an essential tool to maintain customer engagement, respond to inquiries, and drive sales amidst widespread store closures and social distancing measures (Sigala, 2020). Virtual Store Tours: Through AR and VR technologies, customers can undertake virtual store tours, browsing products from their homes (Liu, 2020). Real-Time

Assistance: Retailers can provide real-time assistance via video calls, instant messaging, or AI chatbots, offering immediate support and consultation to online customers (Dacko, 2017). **Personalized Product Demonstrations:** AR and VR can be used for personalized product demonstrations, providing customers with immersive, detailed insights into products (Kim, 2019). **Greater Accessibility:** Remote assistance extends retail services to customers unable to visit physical stores, a scenario amplified during pandemic-related lockdowns (Pantano, 2020). **Enhanced Customer Experience:** By providing real-time support and interactive product presentations, remote assistance enriches the shopping experience, fostering customer loyalty (Poushneh, 2017). **Boosted Sales:** Detailed product information and personalized customer support can facilitate informed purchasing decisions, potentially boosting sales and average order values (Sigala, 2018). While remote assistance offers significant advantages, it is not devoid of challenges. **Technological Barriers:** Customers unfamiliar with digital technology may find it challenging to utilize remote assistance services. Retailers must ensure user-friendly interfaces and provide necessary guidance (Dwivedi, 2020). **Privacy Concerns:** The increased digital engagement raises data privacy concerns. Retailers must prioritize secure data handling practices and comply with data protection regulations (Martin, 2017). The COVID-19 pandemic has accelerated the adoption of remote assistance in assisted retail, transforming the retail landscape. Despite the challenges, this shift towards a more digitally integrated, customer-centric retail experience is likely to persist beyond the pandemic, making remote assistance a vital tool in the retail arsenal.

2.3. Covid-19 impact

COVID-19 has impacted retail in multiple ways. Initially, non-essential retail faced widespread closure, causing a surge in unemployment (Hobijn, 2021). Consumer behavior shifted towards online channels, creating new opportunities and challenges for retailers. Panic buying and stockpiling exacerbated supply chain challenges, creating gaps in inventory and disruptions in logistics (Ivanov, 2020). Despite these challenges, some retailers thrived by pivoting their operations and capitalizing on e-commerce and delivery options. With consumers confined to their homes, online shopping saw a dramatic increase (Ling, 2021). Retailers responded by accelerating digital capabilities, improving their online platforms, and offering contactless delivery options. The concept of omnichannel retailing, a multi-channel approach that provides the customer with an integrated shopping experience, has become even more critical (Verhoef, 2015). The need for safety and hygiene gave rise to the adoption of contactless payments. These systems, like Apple Pay or Google Wallet, use NFC (Near Field Communication) technology to enable transactions without physical contact (Hayashi, 2020). VR and AR technologies have seen increased adoption, helping retailers to provide immersive online experiences. These technologies allow customers to visualize products in a realistic environment before making a purchase (Rese, 2014). AI and ML have become essential tools for retailers, assisting in demand forecasting, inventory management, and customer service. For instance, chatbots are used to automate customer service and improve the shopping experience (Huang, 2020). The COVID-19 pandemic has spurred significant changes in the retail industry. The emergent technologies have not only provided solutions to navigate the challenging landscape but also paved the way for a more digitized future of retail.

2.4. Methods

Based on previous defined world trends analysis of czech market will be performed. This analysis consists of two steps. First step is analyze publicly available source like web sites and other means of communication which could be publicly observed. Second step is defining flag ship stores of these companies. Flag ship stores will be performed in person by visiting these stores and trying to observe as many mentioned features as possible. This could not be considered as exact measurements, but the goal is to see if

even on the czech market there are modern features after pandemic of covid-19 or if czech market is still behind world trends. Another fact to consider which should help to this observation is hypothesis, that companies would like to present modern features to get more natural publicity. This hypothesis will be confirmed or rejected in conclusion.

3. Results

Following table shows results of public source analysis and personal visits of flagship stores of several companies defined in previous chapters. Goal is not to evaluate companies between each other or looking for most modern company and because of that results are consolidated into just type of industry.

Tab 2: Presence of modern informatics trends in Czech assisted retail.

	Banks	Insurers	Telco
Phygital	No	No	Yes
The metaverse	No	No	No
Hyper-personalization	Yes	Yes	No
Web3	No	No	No
Chatbots	Yes	Yes	Yes
Remote assistance	No	No	Yes

Source: Own research.

During performed analysis only small sample of shops (which are presented as flagship or biggest) was visited. It does not make sense on this small sample to count occurrences of any of defined trends. Results are in Boolean format to just have idea about modernisation condition of various elements.

4. Discussion

It is fair to say that presence of modern trends in czech retail market was evaluated with very low criteria, that means that if some features are presented by company and called by modern trends, maturity was not evaluated. For phygital there was just few experimental elements in one of telco companies shop, but it is enough to satisfy criteria. Elements of The Metaverse are not present in any of defined shops. Reason for this could be that whole Metaverse platform is currently target to US market and it maybe hard to implement anything outside of US. Hyper-personalization was observed in both insurance and banking companies. In general, this type of companies has more personal information (about spending and properties) than any other type of company. With having just publicly available information it is hard to tell if they are indeed using AI or some machine learning models to evaluate their personalised offerings, but speed and correctness often leads to expectations that they do. Mostly in banking sector there is expectations that Web3 and blockchain technology would take place, but during observation this was not confirmed in opposite to some worldwide banks. Chatbots are not particularly new technology, but with new methods it is easier than before to implement very advanced ones. Especially using GPT technology, which is publicly available since 2022 it means big bang in this field and chatbots are in some form present in all fields. Surprisingly remote assistance in retail was present only by one company from the list. Expectation is that remote assistance boosted by pandemic of covid-19 would be key technology in assisted retail to save resource and optimize networks, but it didn't happen (yet) oppose to world trends.

5. Conclusion

In conclusion, this in-depth examination and comparative analysis of modern trends in the Czech retail sector have revealed a notable lag behind the global advancements in the industry. Despite the rapid evolution and adaptation in the retail landscape worldwide, driven by technological progression, customer expectations, and global market dynamics and especially covid-19 development boost, the Czech retail sector seems to have stagnated or, at best, developed at a slower pace. However, the relative underdevelopment should not be mistaken for a permanent state of affairs. The Czech Republic has

demonstrated resilience and adaptability across various economic sectors in the past, and there is immense potential for growth and evolution within its retail industry. While current observations suggest a gap, the dichotomy of progress serves as an important point of introspection, providing valuable insights into areas requiring focused efforts for advancement. It opens avenues for retailers, and stakeholders to understand the key areas of global retail that could be assimilated or innovatively adopted in the local context. Undeniably, every market and every innovation has unique characteristics and contextual challenges. Our findings should not necessarily be interpreted as a failure on the Czech retail sector's part, but rather as an opportunity for strategic realignment. Our future research will focus on investigating possible socio-economic, regulatory, and infrastructural barriers that might be inhibiting the Czech retail market's pace of growth. Furthermore, we will explore potential strategies and actionable plans for accelerating development to match global retail trends. We believe that a detailed exploration of these perspectives will contribute to the existing body of knowledge and provide a blueprint for the future development of the Czech retail sector.

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OPTIMIZATION OF THE COMPLEX MULTI-FACILITY LOCATION PROBLEM USING MICROSOFT EXCEL

^aPETR NĚMEC, ^bMICHAL ŠMEREK, ^cONDŘEJ PEKAŘ,
^dMIROSLAV PECINA

University of Defence, Kounicova 65, Brno 662 10, Czech Republic

*email: ^agerman.petr@seznam.cz, ^bmichal.smerek@unob.cz,
^condrej.pekar@unob.cz, ^dmiroslav.pecina@unob.cz*

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Abstract: The article presents the possibility of solving a complex Multi Facility Location Problem in Excel and its use in military practice. Based on a simple model example (25 branches, 5 centers), it gradually verifies the individual steps leading to the solution of the optimization requirement of increasing (decreasing) the number of centers, weight of branches, capacity of centers, and forbidden (permitted) areas. These examples are solved using the evolutionary method in Excel. Finally, this method solves an example in the range of 100 to 3 and the result is verified by calculation by the metaheuristic method. This demonstrates the ability to solve this type of tasks in the proposed way.

Keywords: Multi-Facility Location Problem (MFLP), Excel; Solver; Evolutionary algorithm; Simulated Annealing; logistics; benchmark instance

1 Introduction

In our work (1), we have shown that MFLP tasks can be solved using office software on personal computers. In the work (2) the method of solution and test tasks were presented, on which the solution of MFLP with weight was verified. To get closer to solving practical problems, we tried to implement other options into the method. Thus, we came to the proposal of solving complex tasks, including the weight of points - MFLP-W, the capacity of centers - MFLP-C and work with forbidden or, conversely, ordered areas - MFLP-A of the respective MFLP-R. Areas are defined as convex polygons.

The purpose of this work is to demonstrate the capability of Excel-Solver's evolutionary procedure to solve the MFLP. The test task is designed so that partial evaluation of the obtained results is possible without the need for additional control calculations. It has been confirmed that the proposed methodology can successfully address intricate test cases, regardless of the quantity of points, centers, and areas involved, provided that simple test cases can be tackled using this approach. In (1) and (2), the dependence of the complexity of the test task and hardware on the achieved results was investigated. It was found that the inaccuracy of the calculations using the evolutionary method can be successfully compensated by repeating the calculations.

The article is arranged as follows. After reviewing the literature on this topic in section 1.1. and its possible use on the example of military practice in section 1.2., Section 1.3 outlines the presentation of the objective of this study, as well as the formulation of the MFLP-W, MFLP-C, MFLP-A, and MFLP-R problems. Section 2. describes the methods used, the comparative task and the procedure leading to the solution of the required type of MFLP. The test task was designed based on the results of works (1) and (2). Calculations are performed on a regular PC. The test task is mainly used to verify that the design of the problem-solving procedure is correct, the accuracy of the result in this phase of verification is not emphasized. The results of the optimization of individual tasks and their combinations are presented in section 3. There are also listed the problems that were observed for individual tasks and the resulting limitations. Section 4 presents a discourse and draws conclusions for this manuscript.

1.1 Related work

In the literature review, we focused on solving the above types of problems - using heuristic methods and the using of Excel in solving localization problems.

The paper *An efficient algorithm for facility location in the presence of forbidden regions* (3) examines a constrained Weber problem. This work addresses the problem of locating a new facility in convex polygonal restricted regions. Minimize the weighted distance between the new facility and n pre-existing facilities. A forbidden region is assumed to be a plane's restricted travel and facilities area. It is also accepted that this setting uses the Euclidean-distance metric to measure distance. This work presents a nonconvex programming approach. Iteratively solving unconstrained problems yields a local optimum for the starting restricted problem. The material offers numerical examples.

The Weber problem involves placing a new facility on a two-dimensional plane among a finite number of pre-existing facilities. Minimize the weighted sum of distances between the new and existing facilities. This issue is changed when facilities are on opposite sides of a linear obstacle. Rivers, highways, borders, and mountains are frequent barriers. Manuscript *Planar Weber location problems with line barriers* (4) discusses non-convex optimization techniques and structural insights. Distance function and barrier passage number and placement determine the difficulty.

Designing a distribution network in a supply chain system: Formulation and efficient solution procedure (5) examines the process of establishing an effective distribution network. The essay addresses supply chain distribution network architecture. This comprises finding appropriate locations for production plants and distribution warehouses and developing successful techniques for getting items from the plants to the warehouses and from the warehouses to end customers. The study addresses these issues. The goal is to find the best plant and warehouse numbers, locations, and capacities to meet customer demand while minimizing distribution network costs. Studying reveals storage and plant capacities. This computational study evaluates production and distribution planning integration. A mixed integer programming model and efficient heuristic solution were developed for the supply chain system problem.

An efficient solution method for Weber problems with barriers based on genetic algorithms (6) determines the optimal location of a new facility in relation to a pre-existing set of facilities in a two-dimensional plane, accounting for convex polyhedral barriers. Barriers are assumed to be areas where facilities and travel are prohibited. A few convex subproblems can simplify the non-convex optimization issue. The Weiszfeld algorithm solves these subproblems, especially those using the Weber objective function and Euclidean distances. The present work uses a genetic algorithm to iteratively choose subproblems to quickly find a solution for the overarching problem. Visibility arguments reduce the number of subproblems to consider, and numerical examples are provided.

Placing a finite size facility with a center objective on a rectangular plane with barriers (7) addresses finite-size 1-center placement on a rectangular plane with barriers. As described in reference (7), the proposed solution places a finite facility with a center objective on said plane. Barriers impede amenities and movement. Facilities are located in cells. Cells are evaluated by their corners to meet the center's minimax target. The facility dominated when completely enclosed in cells with one, two, or three corners. When the facility intersects gridlines, distance function analysis is difficult. This case's difficulties have been studied and translated into a linear or nonlinear program, depending on the viable region's convexity. A numerical example illustrates the paper's complexity study.

Integrated use of fuzzy c-means and convex programming for capacitated multi-facility location problem (8) solves a capacitated multi-facility location problem using a fuzzy c-means clustering approach. The challenge involves capacitated supply centers serving known demand sites. Fuzzy c-means and convex programming are used. The fuzzy c-means algorithm assigns data points to several clusters with different membership levels. This feature distributes demand among supply centers. An gradual strategy starts with two and ends when each cluster has enough capacity to match its demand. Each cluster group and model is treated as a facility location challenge. Next, convex programming optimizes transportation costs to refine each fuzzy c-means facility location problem. The proposed method has been tested in several facility location scenarios and compared to center of gravity and particle swarm optimization algorithms. This study presents real-world asphalt producer statistics from Turkey. The numerical results show that the suggested methodology beats traditional fuzzy c-means and the combined use of center of gravity strategies for transportation costs.

Two meta-heuristics for a multi-period minisum location-relocation problem with line restriction (9) investigates a multi-period minisum location-relocation problem with rectilinear distance. The mixed-integer nonlinear programming (MINLP) paradigm includes a line-shaped barrier limitation. The barrier starts uniformly in the aircraft. The model minimizes the total costs related to the predicted weighted barrier distance between the new facility and the current ones and relocation costs that rely on location within the planning horizon. Next, a restricted area-based lower limit is set. Numerical examples validate the model. Results show that the optimization software can solve smaller difficulties. The optimization software can't solve large issues quickly. Genetic and imperialist competitive meta-heuristics are proposed in the paper. Finally, the results are compared.

Article *Combining possibilistic linear programming and fuzzy AHP for solving the multi-objective capacitated multi-facility location problem* (10) proposes a solution. The technique evaluates quantitative and qualitative aspects from many angles. Decision-makers must consider both factors to accurately represent complex real-world applications. This study presents a novel approach that integrates a two-phase possibilistic linear programming technique and a fuzzy analytical hierarchical process method to optimize two objective functions, "minimum cost" and "maximum qualitative factors benefit," in a four-stage supply chain network involving suppliers, plants, distribution centers, and customers, while accounting for vagueness. This study's numerical example shows the methodology's findings. Conclusions discuss this approach's benefits.

INSPM: An interactive evolutionary multi-objective algorithm with preference model (11) models DM preferences using the Interactive Non-dominated Sorting algorithm with Preference Model (INSPM). The IN-SPM identifies a non-uniform sampling method for the Pareto-optimal front that uses detailed sampling for the decision maker's favorite regions and coarse sample for the non-preferred regions. A Radial Basis Function (RBF) network is used to calculate the Decision Maker (DM) utility function from ordinal data from DM queries. INSPM invokes the DM's preference model using DCD density control. This strategy improves Pareto-optimal front sampling density by increasing sampling in favored regions and decreasing it in non-preferred regions.

In *The capacitated multi-facility weber problem with polyhedral barriers: Efficient heuristic methods* (12), polyhedral barriers prevent facility placement and transit. Transportation costs depend on both linear distances and polyhedral barrier sizes and location. This circumstance creates a non-convex optimization problem, making solution difficult. This paper proposes location-allocation and discrete approximation heuristics tailored to the problem. Randomly generated test instances underwent extensive computational experiments. The results show that the heuristic approaches are successful and yield promising results for this difficult topic.

Exact and approximate heuristics for the rectilinear Weber location problem with a line barrier (13) expands the multi-Weber facility location problem to include rectilinear-distance and crossings through non-horizontal line barriers. For the single-facility situation, a divide-and-conquer precise heuristic outperforms other literature heuristics. An alternate-location-allocation heuristic using precise and inexact methods solves the problem of managing multiple facilities. Large instances can be handled with a polynomial-time heuristic. This method produces near-optimal, fast solutions with a small gap. A benchmark converts the core problem into a p-median problem for testing. Experimental results show that the recommended heuristics work. These heuristics produce high-quality results in reasonable time.

This paper addresses the capacitated multi-facility Weber issue using rectilinear, Euclidean, squared Euclidean, and lp distances. Identifying m Euclidean plane facilities with limited capacity to satisfy n clients while minimizing transportation costs is the issue. The distance between clients and facilities and the number of units being delivered determine the cost of transportation, which is publicly available. This work proposes three new heuristic methods based on simulated annealing, threshold acceptance, and genetic algorithms. Benchmark results show that heuristics create high-quality solutions. The paper *Solving the Capacitated Multi-Facility Weber Problem by Simulated Annealing, Threshold Accepting and Genetic Algorithms* (14) found that the heuristic using simulated annealing and the two-variable exchange neighborhood structure performed best (14).

Facility placement on a two-dimensional plane is restricted in restricted planar location challenges. Congested polygons are highly inhabited. Due to restricted space, these places make facility location difficult, however transportation is achievable at a fixed cost. This study shows that determining optimal locations in congested regions on the Euclidean plane is a broader version of the two extensively researched restricted planar facility location problems involving forbidden regions and barriers. The constrained planar location problem is addressed by three metaheuristic algorithms with local search procedures. User interface modules execute algorithms on test instances and do computational experiments. The study shows that the proposed algorithms can solve large issues (15).

In addition to our own resources (1) and (2), the MFLP solution with weight, capacity, and areas in Excel, or other widely available software, is not described in the available literature. Because the terminology is ambiguous, Section 1.2. defines the problems and their designations used in this work.

1.2 Application of MFLP in supporting the decision-making process in planning the deployment of critical artillery support locations

Solving sophisticated MFLP tasks using MS Excel can find applications in several fields. The previous article outlined some possible applications of the MFLP method (1). These were applications for military logistics and support of the Tactical Decision Support System. The use of the MFLP method is shown in this article in the practical example of logistical support of artillery units in combat.

Artillery has played and continues to play an essential role on the battlefield, as evidenced by current conflicts, especially the one in Ukraine (16,17). However, the activity of artillery units is tied to logistics capabilities. This is mainly in the material supply, without which artillery cannot provide fire support. Artillery significantly burdens logistical support and thus plays a critical role in providing continuous fire support on the battlefield (18).

Artillery fire units have a limited amount of supplies available for the execution of firing missions, which they are able to carry themselves. This is particularly the amount of ammunition, fuel, and other materials. These supplies must be replenished during combat (19).

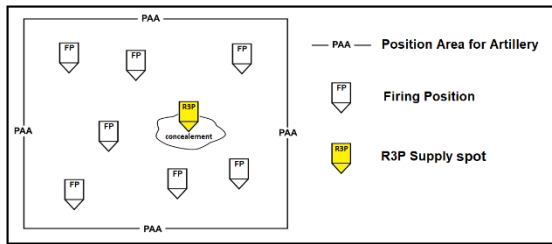


Figure 1. Scheme of artillery units in combat

Artillery units are within the operation deployed in areas, so-called Position Area for Artillery, from where they provide fire support and in which they can maneuver without any restrictions. Inside the Position Area for Artillery, it is possible to distinguish (among other things) two basic types of positions. Firing positions are specific locations where artillery units conduct fires. The number of firing positions depends on factors like tactical situation, number of units, and so on (20,21).

The second type of position is designated to hide artillery units and replenish supplies. After completing the firing mission, the artillery units maneuver to a concealed position, remaining in the breaks between firing missions. These concealments are chosen to protect from direct observation from the enemy while being close to the firing positions. In these locations, material maintenance is carried out in combat conditions, but in particular, supply spots are established, where ammunition, fuel, and other materials are replenished. In a military environment, these resupply spots are called R3P - rearm, refuel, resupply points. R3P spots are established in advance (if the tactical situation allows it) close to firing positions so that the resupply takes place as efficiently as possible. The amount of these supply spots in the area depends on the number of firing positions. However, it is generally possible to say that one supply spot can provide supplies for multiple units – thus also firing positions in the area (22). For the article, we can thus distinguish two basic types of locations. Firing positions represent branches, while supply spots (R3P points) represent the centers we try to find using the specified criteria.

Using the MFLP method to objectively find locations for these supply spots based on the location of firing positions is possible. Such an application can then serve the needs of the commander's decision on the location of these supply spots in the Military Decision Making Process (MDMP) process and thus facilitate his decision. The number and locations of firing positions and the corresponding supply spot(s) are chosen based on several criteria. These criteria can be the tactical situation, the operation phase, the terrain conditions, and the possibilities of concealment or the number of units operating. Artillery units can use firing positions depending on the nature of the firing missions. For this, the weighting criteria of the MFLP algorithm can be used. Individual firing positions can be prioritized by weights, depending on the tactical situation or, e.g., the operation phase. In determining the positions of supply spots under these conditions, it is possible to achieve that they will be chosen concerning the weight - the priority of the firing positions. We can also include the capacities of individual supply spots in the algorithm. The capacity of supply spots expresses the ability of the supply spot to provide ammunition and other material for only a certain number of spots, i.e., in our case, the units in the firing position. The number of supply spots (centers) can thus be adjusted to ensure sufficient supplies for all units in firing positions in the position area for artillery. The least but not last criteria with which the MFLP algorithm can work are area constraints. When entering the calculation of supply spots, it is possible to determine the areas in which they must or must not be located. This means it is possible to include the boundaries designated for artillery units in calculating supply spot locations so that these spots are located inside this area. Similarly, it is then possible to proceed with the condition that the supply spots are not located inside the forbidden area. Forbidden areas may represent places where the geographical conditions do not allow for the deployment of supply spots, etc.

Position determination of the supply spots need not pose a problem when it is necessary to determine the supply spot (center) for only a few firing positions (spots). However, if there are more spots, an objective assessment of the location of the supply spots (centers) can be problematic.

1.3. Problem formulation

The formulation of the problem is processed for each test separately. Tests are designed from the simplest to the most complex.

1.3.1 TEST A-1 (5/25)

There exist a set of p points, for which the coordinates of their respective positions are known. There are c centers where the coordinates of their positions are unknown. The variable c is a positive integer and p is an integer greater than or equal to c . The aim is to determine the locations of the centers in such a way that the total distance between each center and its designated points is minimized. Each individual point will be allocated to a single center.

A practical example is an artillery battery with existing firing positions (P_j) for which needs to be set up supply spots (C_i) that will provide supplies for artillery units in firing positions. The firing positions' coordinates are established, while the supply locations will be formed anew. The specific locations of the supply spots and the corresponding firing positions they are intended to serve have not been specified. For this test is $c=5$ and $p=25$.

The problem can be expressed mathematically in the following manner. Let $P_j, j = 1, 2, \dots, p$ be a set of points $P = \{P_1, P_2, \dots, P_p\}$; the coordinates of these points are defined as $[P_{x_j}, P_{y_j}], j = 1, 2, \dots, p$. Let $C_i, i = 1, 2, \dots, c$ be a set of centers $C = \{C_1, C_2, \dots, C_c\}$; The precise coordinates of said points remain unknown, as they are actually under optimization.

The Euclidean distance between a center $C_i = [C_{x_i}, C_{y_i}], i = 1, \dots, c$ and point $P_j = [P_{x_j}, P_{y_j}], j = 1, 2, \dots, p$. The value is determined based on the computation outlined in equation [1]. In a general sense, it is possible to utilize any spatial configuration, dimensional quantity, and metric for measuring distance.

$$d_{ij} = d(C_i, P_j) = \sqrt{(P_{x_j} - C_{x_i})^2 + (P_{y_j} - C_{y_i})^2}, \quad [1]$$

$i = 1, \dots, c, j = 1, \dots, p$

where $d_{ij} = d(C_i, P_j)$ is the distance between center C_i and point P_j ; C_{x_i}, C_{y_i} are coordinates of the center C_i , and P_{x_j}, P_{y_j} are coordinates of point P_j .

The solution is therefore the matrix X (assignment matrix) described in formula [2]

$$X = (x_{ij})_{c \times p} = \begin{pmatrix} x_{11} & \dots & x_{1p} \\ \vdots & \ddots & \vdots \\ x_{c1} & \dots & x_{cp} \end{pmatrix}, \text{ where} \quad [2]$$

$$x_{ij} = \begin{cases} 1 & \dots \text{assigned} \\ 0 & \dots \text{unassigned} \end{cases}$$

Each point is assigned to exactly one center. Therefore, in each column there is exactly one "1" and $(c - 1)$ "0", so it must be:

$$P_j: \sum_{i=1}^c x_{ij} = 1, \quad j = 1, 2, \dots, p. \quad [3]$$

Formula [4] displays the optimization function for the MFLP problem. The aforementioned statement pertains to the total of the distances that exist between each point and the centers that have been assigned to them. The objective is to determine the optimal positions of c centers in order to minimize the objective function D . In the context of two-dimensional space, the number of continuous optimization variables is $2c$.

$$D = \sum_{j=1}^p (\sum_{i=1}^c x_{ij} d_{ij}) \rightarrow \min \quad [4]$$

1.3.2 TEST A-2 (3/25)

The formulation is the same as for test A-1 (5/25) but $c=3$

1.3.3 TEST A-3 (3/25 W)

The dataset consists of a set of p points, each with known positional coordinates and an associated weight. There are c centers where the coordinates of their positions are unknown. The variable c is a positive integer and p is an integer greater than or equal to c . The aim is to determine the locations of the centers such that the total weighted distance between each center and its designated points is minimized. Each data point will be allocated to a single centroid that is in closest proximity to it. A practical example is an artillery battery with existing firing positions (P_j) for which needs to be set up supply spots (C_i) that will provide supplies for artillery units in firing positions. The locations of the firing positions are known; the supply spots will be built as new. In this case the firing positions have a different supply requirements depending e.g. on the phase of operation or may be prioritized for another reason. These different supply requirements are taken into account in the calculation by means of weights. For this test is $c=3$ and $p=25$.

The mathematical expression of this particular problem is identical to that of the instance A-1, but every P_j have a weight $w_j, j = 1, 2, \dots, p$; where w_j represents a preference for some points over others.

Formula [1] is utilized to calculate the Euclidean distance between a center and any given point. However, the coordinates of the centers are determined by means of formula [5].

For a given solution given by the matrix $X = (x_{ij})_{exp}$ the coordinates of all centers can be determined $C_i = [Cx_i, Cy_i], i = 1, 2, \dots, c$ as follows:

$$\begin{aligned} Cx_i &= \frac{\sum_{j=1}^p P_j x_{ij} \cdot w_j}{\sum_{j=1}^p w_j \cdot x_{ij}}, \\ Cy_i &= \frac{\sum_{j=1}^p P_j y_{ij} \cdot w_j}{\sum_{j=1}^p w_j \cdot x_{ij}}, \quad i = 1, 2, \dots, c. \end{aligned} \quad [5]$$

Formula [6] demonstrates the optimization of the MFLP-W problem. The aforementioned pertains to the summation of distances that have been weighted between each point and their respective designated centers. The purpose of the function is to calculate the sum of distances between all points and their respective assigned centers, with each distance being weighted.

$$D = \sum_{j=1}^p (w_j \sum_{i=1}^c x_{ij} d_{ij}) \rightarrow \min \quad [6]$$

1.3.4 TEST A-4 (3/25 C)

There exist a set of p points, for which the coordinates of their respective positions are known. There are c centers where the coordinates of their positions are unknown. The variable c is a positive integer, where $c \geq 1$, and the variable p is a positive integer, where $p \geq c$. The aim is to determine the locations of the centers in such a way that the total distance between each center and its designated points is minimized. Each individual point will be allocated to a single center. Assign a capacity to each center that restricts the upper limit of points that can be assigned to given center.

A practical example is an artillery battery with existing firing positions (P_j) for which needs to be set up supply spots (C_i) that will provide supplies for artillery units in firing positions. The firing positions' coordinates are established, while the supply locations will be set up as novel deployments. The specific locations of the supply spots and the corresponding firing positions they are intended to serve have not been specified. Each supply spot shall have a capacity representing the

maximum number of points it is able to provide supplies for. For this test is $c=3$ and $p=25$.

The mathematical formulation of this problem is identical to that of example A-1, with the exception that each center possesses a capacity $k_i, i = 1, 2, \dots, c$; where k_i represents the maximum number of points that are allocated to a given center.

Any number of points can be assigned to center C_i , but that the capacity of the center must not be exceeded. The relation defined by formula [7] therefore applies.

$$C_i: \sum_{j=1}^p x_{ij} \leq k_i, \quad i = 1, 2, \dots, c. \quad [7]$$

Formula [1] is utilized to compute the Euclidean distance between a center and any point in a two-dimensional space. Formula [4] displays the optimization function for the MFLP-C problem. The aforementioned pertains to the aggregate of distances linking each point to its designated centers. The objective is to determine the optimal positions of c centers such that the objective function D is minimized while ensuring that the capacity of each center is not surpassed. In the context of two-dimensional space, the number of continuous optimization variables is $2c$.

1.3.5 TEST A-5 (3/25 CW)

The given dataset comprises of p discrete points, each with known positional coordinates, a corresponding weight. Every center has a specified capacity. The aim is to determine the optimal locations of the centers such that the total weighted distance between each center and its designated points is minimized, while ensuring that the capacity constraint of each center is not violated.

A practical example is an artillery battery with existing firing positions (P_j) for which needs to be set up supply spots (C_i) that will provide supplies for artillery units in firing positions. The firing positions' coordinates are established, while the supply locations will be constructed afresh. The specific locations of the supply spots and the corresponding firing positions they are intended to serve have not been specified. Firing posts have a different supply prioritisation represented by weights and each supply spot shall have a capacity representing the maximum number of points it is able to provide supplies for. For this test is $c=3$ and $p=25$.

The mathematical formulation of this problem is the combination of tests A-1 to A-4.

The solution is then the matrix of assignments given in the formula [5], where the center coordinates are calculated as the center of gravity of all assigned points with weights. At the same time, the condition applies that any number of points can be assigned to center C_i , but that the capacity of the center must not be exceeded. This condition is defined by formula [8]:

$$C_i: \sum_{j=1}^p x_{ij} w_j \leq k_i, \quad i = 1, 2, \dots, c. \quad [8]$$

Formula [1] is utilized to compute the Euclidean distance between a center and any point in a two-dimensional space. Formula [6] displays the optimization function for the MFLP-CW problem. The aforementioned pertains to the summation of weighted distances between each point and its corresponding assigned centers. The objective is to determine the optimal positions of c centers such that the objective function D is minimized while ensuring that the capacity of each center is not exceeded. In the context of two-dimensional space, it can be observed that there exist a total of $2c$ continuous optimization variables.

1.3.6 TEST B-1 (3/25 CWA)

The given dataset comprises of p distinct points, each having a designated weight and every center with a specific capacity. The coordinates of these points are known. The aim of this study is to determine the optimal positions of centers such that the total

weighted distance between each center and its assigned points is minimized, while ensuring that the capacity of each center is not surpassed and that all centers are situated within the specified area.

A practical example is an artillery battery with existing firing positions (P_j) for which needs to be set up supply spots (C_i) that will provide supplies for artillery units in firing positions. The firing position coordinates are established and must be situated within the designated artillery position area, along with the newly constructed supply spots. The specific locations of the aforementioned supply spots and the corresponding firing positions they are intended to serve have not been delineated. Firing posts have a different supply prioritisation represented by weights and each supply spot shall have a capacity representing the maximum number of points it is able to provide supplies for. For this test is $c=3$ and $p=25$.

The mathematical expression of this particular problem is identical to that of tests A-5, but all centers must be located in designated area.

The areas in which the centers must be located are defined as convex polygons $V_1 V_2 \dots V_p$; with coordinates of vertices $V_k = [Vx_k, Vy_k], k = 1, 2, \dots, v$.

Consider v functions in formula [9] that are linear to x, y :

$$p_k(x, y) = (Vx_{k+1} - Vx_k)y - (Vy_{k+1} - Vy_k)x - (Vx_{k+1} - Vx_k)Vy_k + (Vy_{k+1} - Vy_k)Vx_k \quad [9]$$

$$k = 1, 2, \dots, v, \quad v+1 := 1$$

If all v in inequalities in formula [10] are valid, then the center C_i lies in the given area, i.e. in a convex polygon $V_1 V_2 \dots V_p$.

$$p_k(V_{k+2}) \cdot p_k(C_i) > 0 \Leftrightarrow C_i \in Hf_{p_k}, \quad [10]$$

where Hf_{p_k} is a half-plane determined by a straight line

$$\overline{V_k V_{k+1}} \text{ and point } V_{k+2}, k = 1, 2, \dots, v, \quad v+1 := 1, \quad v+2 := 2.$$

Formula [1] is utilized to compute the Euclidean distance between a center and any point in a two-dimensional space. Formula [6] depicts the optimization function for the MFLP-CWA problem. Formula [8] demonstrates that it is equivalent to the total of weighted distances between each point and its designated centers. The objective is to minimize the objective function D while ensuring that the capacity of the center is not surpassed by determining the optimal locations of c centers. In the context of two-dimensional space, it can be observed that there exist a total of $2c$ continuous optimization variables.

1.3.7 TEST B-2 (3/25 CWR)

The dataset comprises a set of p points, each with known coordinates, a corresponding weight. Every center has a designated capacity. The aim of the study is to determine the optimal positions of the centers such that the total weighted distance between each center and its assigned points is minimized, while ensuring that the capacity of each center is not surpassed and that all centers are situated outside of the designated restricted area.

A practical example is an artillery battery with existing firing positions (P_j) for which needs to be set up supply spots (C_i) that will provide supplies for artillery units in firing positions. The firing positions' coordinates are determined, whereas the supply spots are to be constructed anew and ought to be situated beyond the restricted zone. The specific locations of the supply spots and the corresponding firing positions they are intended to serve have not been delineated. Firing posts have a different supply prioritization represented by weights and each supply spot shall have a capacity representing the maximum number of points it is able to provide supplies for. For this test is $c=3$ and $p=25$.

The mathematical representation of this particular problem is identical to that of tests B-1, with the exception that all centers are required to be situated outside of the designated area.

Proceeding again from v functions in formula [9]. If at least

one of v inequalities in formula [11] is valid, then the center C_i is not located in the given area, i.e. in a convex polygon [11]

$$V_1 V_2 \dots V_p \cdot p_k(V_{k+2}) \cdot p_k(C_i) < 0 \Leftrightarrow C_i \notin Hf_{p_k},$$

where Hf_{p_k} is a half-plane determined by a straight line

$$\overline{V_k V_{k+1}} \text{ and point } V_{k+2}, k = 1, 2, \dots, v, \quad v+1 := 1, \quad v+2 := 2.$$

Formula [1] is utilized to compute the Euclidean distance between a center and any point in a two-dimensional space. Formula [6] depicts the optimization function for the MFLP-CWR problem. Formula [8] demonstrates that it is equivalent to the total of weighted distances between each point and its designated centers. The objective is to determine the optimal positions of c centers such that the objective function D is minimized while ensuring that the capacity of each center is not surpassed. In the context of two-dimensional space, it can be stated that there exist $2c$ optimization variables that are continuous.

1.3.8 TEST B-3 (3/25 CWAR)

The given dataset comprises of p points, each with known positional coordinates, a corresponding weight. Every center with a designated capacity. The aim is to determine the locations of the centers such that the total weighted distance between all centers and their designated points is minimized, while ensuring that the capacity of each center is not surpassed. Simultaneously, it is required that one of the centers be situated within polygon A, while two centers must be positioned within polygon B.

A practical example is an artillery battery that can be divided into two platoons, each of which has an assigned area in which it operates. Each platoon operates in its assigned area with existing firing positions (P_j) for which needs to be set up supply spots (C_i) that will provide supplies for artillery units in firing positions. The firing positions have been identified, while the supply spots are to be constructed anew and must be situated individually for each platoon within their designated region. The precise geographical coordinates of the aforementioned supply spots and the corresponding firing positions they are intended to serve have not been explicitly delineated. Firing posts have a different supply prioritisation represented by weights and each supply spot shall have a capacity representing the maximum number of points it is able to provide supplies for. For this test is $c=3$ and $p=25$.

In this test, a combination of all the previous conditions is applied.

Formula [1] is utilized to determine the Euclidean distance between a center and any point in a two-dimensional space. Formula [6] displays the optimization function for the MFLP-CWAR problem. Formula [8] demonstrates that it is equivalent to the total of weighted distances between each point and its designated centers. The objective is to minimize the objective function D while ensuring that the capacity of the center is not surpassed by identifying the optimal locations of c centers. In the context of two-dimensional space, the number of continuous optimization variables is $2c$.

2 Materials and methods

This section describes the hardware used to calculate test tasks, the operating system, and applications. There is also a description of the methods used for optimization and auxiliary methods used in partial calculations.

2.1 Hardware and software configuration

Computational analyses were conducted on two distinct computer systems that possessed varying hardware configurations:

HW 1 - CPU: AMD A10-9620P RADEON R5, 10 COMPUTE CORES 4C + 6G 2.50 GHz. Installed memory 8.00 GB RAM.

HW 2 - CPU: INTEL CORE i7-7700 3.60 GHz. Installed memory 32.00 GB RAM. Software configuration - 64-bit operating system, Windows 10 Enterprise LSTC, MS Excel 2016, 64 bit, part of the Microsoft Office Suite, with the Solver add-in installed.

2.2 Evolutionary method

The evolutionary algorithm is classified as a component of Evolutionary Computations and is categorized among contemporary heuristic-based search techniques. Global optimization is a highly effective problem-solving technique for commonly encountered problems, owing to its adaptable characteristics and strong performance derived from Evolutionary Computation. This technology exhibits efficacy in numerous applications characterized by a high degree of complexity. The Solver add-in in Excel was utilized to compute all the enumerated test tasks.

As per the reference (11), the fundamental characteristics of evolutionary algorithms can be delineated as follows. The initial stage involves the execution of a stochastic sampling procedure. The evolutionary algorithm is designed to sustain a group of potential solutions, known as a population. It is possible that a single individual or a group of individuals with similar objectives may be deemed as the optimal solution, while other members of the population may serve as exemplary models in distinct regions of the exploration space, where a superior resolution can be eventually discovered. The evolutionary algorithm introduces stochastic modifications or mutations to one or multiple individuals within the extant population, thereby generating a fresh prospect solution that may exhibit superior or inferior performance relative to the current population. The evolutionary algorithm endeavors to amalgamate components of extant solutions in order to generate a novel solution that incorporates certain attributes of each "parent". The process of combining elements from pre-existing solutions is achieved through a crossover operation. Ultimately, the evolutionary algorithm executes a selection procedure wherein the individuals deemed the "most suitable" within the population are able to persist, while those deemed the "least suitable" are excluded. In the context of a constrained optimization problem, the concept of "fitness" is contingent upon both the feasibility of the solution, as determined by its adherence to all constraints, and the objective function's value. The process of selection constitutes a crucial stage in the evolutionary algorithm's progression towards increasingly optimal solutions.

The algorithm may be expressed in the form of pseudocode notation.

START

Generate the initial population

Compute fitness

REPEAT

Population

Mutation

Crossover

Selection

Compute fitness

UNTIL population has converged

STOP

This method allows for the configuration of convergence values, mutation frequency, base file size, random number, and maximum time without enhancement. The impact of alterations to these parameters on the computation is unspecified; hence, default values were maintained for all computations. Table 1 presents the values of default parameters.

Table 1. Parameters used for optimization in the Excel-Solver

Parameter	Value
Max time	Unlimited
Iterations	Unlimited
Constraint precisions	0,000001
Convergence	0,0001
Population size	100
Random seed	0
Mutation rate	0,075
Maximum time without improvement	30 sec
Max subproblems	Unlimited
Maximum feasible solutions	Unlimited
Integer optimality	1%

2.3 Metaheuristic method

Previous studies have confirmed the effectiveness and outcomes of the MFLP approach through the utilization of metaheuristic techniques (1,2). The utilization of the metaheuristic approach, which is founded on the Simulated Annealing principle, has been employed to evaluate the efficacy of MS Excel in addressing the challenge of continuous multi-variable optimization. The principle being referred to draws inspiration from the annealing process utilized in metallurgy, which involves subjecting a material to controlled heating and cooling in order to mitigate any defects present. The authors implemented the calculation procedure using the C++ programming language. Further elaboration on the metaheuristic approach and the specific algorithm utilized can be found in prior scholarly investigations (1).

2.4 Benchmark values

Table 2 displays the coordinates of the points P utilized in tests A and B. The point topology utilized in the artificial benchmark A has been intentionally structured in a unique manner, thereby enabling the anticipation or partial anticipation of a solution.

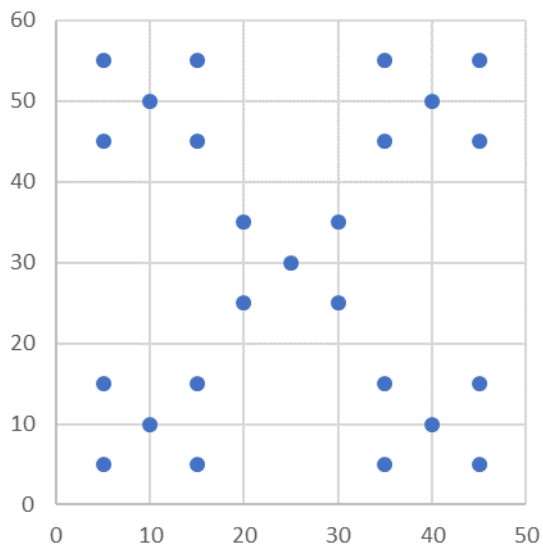


Figure 2. Benchmark A, B

Table 2. Coordinates of points

x	y
5	5
15	5
35	5
45	5
10	10
5	15
15	15
35	15
45	15
40	10
5	45
15	45
35	45
45	45
10	50
5	55
15	55
35	55
45	55
40	50
20	25
30	25
20	35
30	35
25	30

Table 3 lists the terms used and their explanations.

Table 3. Definitions of terms used

Name of term	Explanation
Minimal	Minimal value from set of 100 results
Average	Average value from set of 100 results
Dif. ref-min	Difference between reference and minimal value (%)
Standard dev.	Standard deviation for set of 100 results
Avg. time	Average time of computing one result in set of 100 results

3 Results

The results section provides a concise and objective summary of the experimental and computational data and presents the findings obtained from the conducted research. Data and results are shown in the form of tables and figures, followed by a comprehensive interpretation of the results.

3.1. Results, TEST A

Test tasks A are optimized on HW1, Test tasks A are used to verify the applicability of the method and to confirm the expected result.

3.1.1 TEST A-1 (5/25)

The task of finding 5 centers for 25 points is solved first. The procedure is described in detail in Section IV. The optimization conditions and the result are in Table 4.

Table 4. Results of test A-1

Number of centers		5	
Number of points		25	
Total distance		141.4683926	
Center	Number of assigned points	x	y
1	5	40.00578353	10.00500703
2	5	39.99977012	49.99824379
3	5	9.994063198	50.00695307
4	5	25.00818919	30.01828226
5	5	10.00049883	10.00833797

For this problem, it can be predicted that the correct solution will be the position of the centers in the middle of each group of five points. This prediction is confirmed by calculation and graphically shown in Fig. 3.

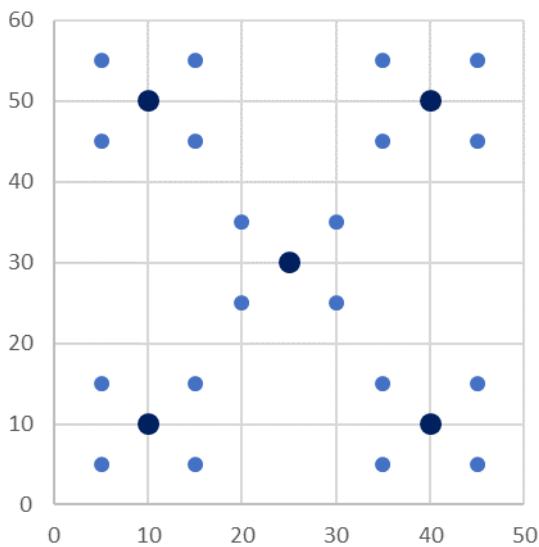


Figure 3. Result of optimization test A-1

3.1.2 TEST A-2 (3/25)

The number of centers is reduced to 3 in this test. Points are assigned to the center using the MATCH and COUNTIF functions. The optimization conditions and the result are in Table 5.

Table 5. Results of test A-2

Number of centers		3	
Number of points		25	
Total distance		294.6004439	
Center	Number of assigned points	x	y
1	13	25.03041478	45.25362532
2	6	10.11654392	10.18144429
5	6	39.98807409	10.01568527

For this problem, it can be predicted that the centers are moved and number of assigned points are changed. This prediction is confirmed by calculation and graphically shown in Fig. 4.

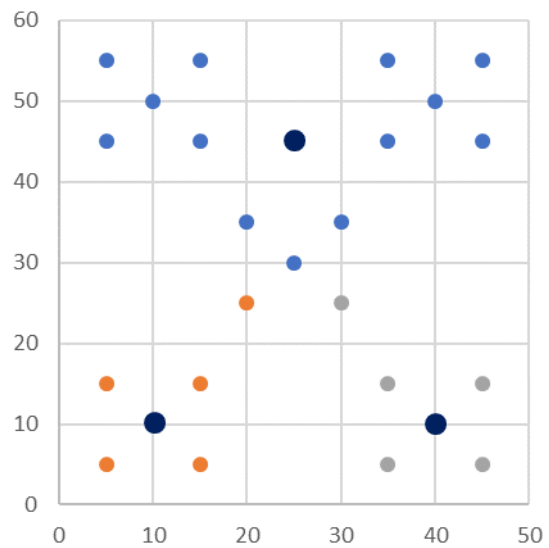


Figure 4. Result of optimization test A-2

3.1.3 C.TEST A-3 (3/25 W)

In this test, the weight is added to three points. The optimization conditions and the result are in Table 6.

Table 6. Results of test A-3

Number of centers		3	
Number of points		25	
Weights		Points [5,5]; [45,5]; [25,30] have a weight of 3, the remaining points have a weight of 1.	
Total distance		341.7222172	
Center	Number of assigned points	x	y
1	5	7.173812421	7.138157584
2	15	25.0017582	38.30947595
3	5	42.63724447	7.365523656

For this task, it can be predicted that the position of the centers will shift towards the points with weight 3 and a change in the number of points assigned to the centers. This prediction is confirmed by calculation and graphically shown in Fig. 5.

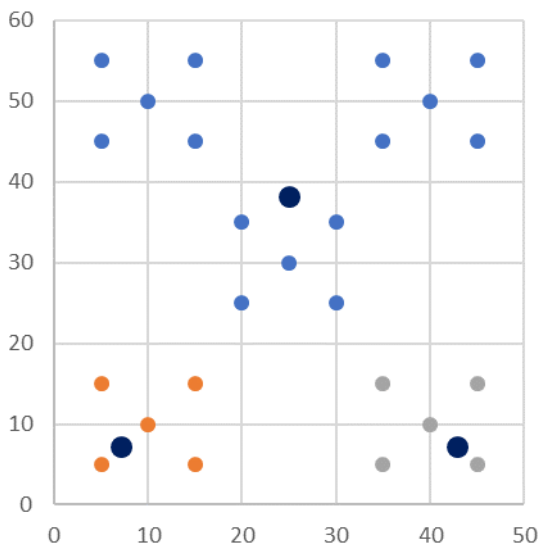


Figure 5. Result of optimization test A-3

3.1.4 TEST A-4 (3/25 C)

Furthermore, the task of finding 3 centers for 25 points is solved, in which the maximum capacity is set for the centers - the capacity corresponds to the number of assigned points. The optimization conditions and the result are in the Table 7.

Table 7. Results of test A-4

Number of centers		3	
Number of points		25	
Capacity of centers		All centers have a maximum allowed capacity (number of assigned points) 9.	
Total distance		331.3074116	
Center	Number of assigned points	x	y
1	8	12.37293583	44.08488544
2	8	35.47962436	42.66568074
3	9	33.91542714	6.917351073

For this task can be predicted, that the position of the centers will shift and the number of points assigned to the centers will change. This prediction is confirmed by calculation and graphically shown in Fig. 6.

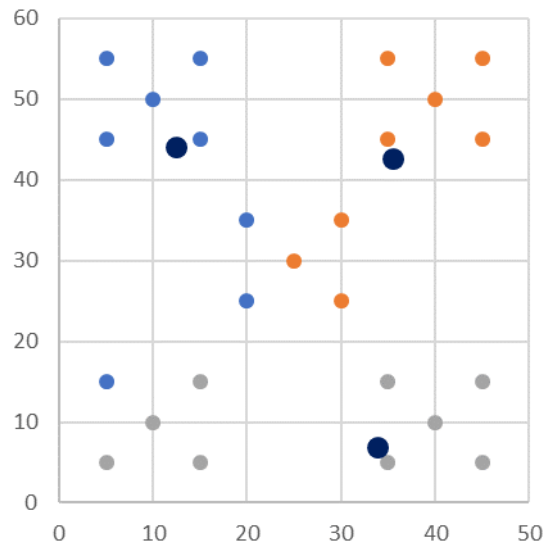


Figure 6. Result of optimization test A-4

3.1.5 TEST A-5 (3/25 CW)

This task combines the capacity of the centers and the weight of the points. The maximum capacity is set for the centers, i.e. the sum of the weights of the assigned points. Weight of the assigned points is the same as in test A-3 (3/25 W). The optimization conditions and the result are in Table 8.

Table 8. Results of test A-5

Number of centers		3	
Number of points		25	
Capacity of centers		All centers have a maximum allowed capacity (sum of weights of assigned points) of 11. Points [5,5]; [45,5]; [25,30] have a weight of 3, the remaining points have a weight of 1.	
Total distance		407.6103343	
Center	Sum of weights of assigned points	x	y
1	11	15.0877231	47.09785915
2	9	41.08188208	15.27571591
3	11	13.55289245	14.13270853

For this task can be predicted, that the position of the centers will shift, and the number of points assigned to the centers will change. This prediction is confirmed by calculation and graphically shown in Fig. 7.

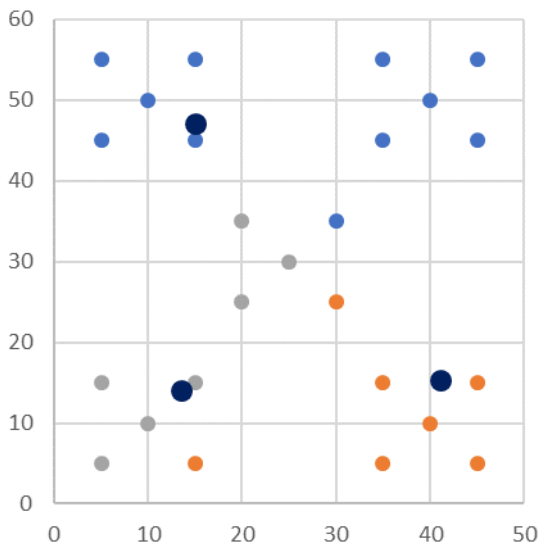


Figure 7. Result of optimization test A-5

3.2 Results, TEST B

Test tasks B are optimized on HW1, Test tasks B are used to verify the applicability of the method and to confirm the expected result.

To optimize the tasks in which the area in which the centers can be located is determined, it is necessary to add to the Excel workbook functions that can determine the mutual position of the center and the convex polygon. The output of these functions is the logical value TRUE if the center lies inside the polygon. By combining these values, different conditions for optimization can then be set. Benchmark A test tasks are used to verify the applicability of the method and to confirm the expected result. Two areas are prepared in the test tasks. The coordinates of the vertices of convex polygons A and B are given in Table 9.

Table 9. Coordinates of convex polygons A and B

Ax	Ay	Bx	By
15	55	5	5
14	54	35	7
21	35	30	25
25	36	6	21
45	52	2	10

3.2.1 TEST B-1 (3/25 CWA)

This task combines center capacity and point weight and adds work with areas. The maximum capacity is set for the centers, i.e. the sum of the weights of the assigned points, all centers must lie in area A or B or both. The optimization conditions and the result are in Table 10.

Table 10. Results of test B-1

Number of centers		3	
Number of points		25	
Capacity of centers		All centers have a maximum allowed capacity (sum of weights of assigned points) of 11.	
Number of centers in areas A,B		3	
Total distance		415.3432088	
Center	Sum of weights of assigned points	x	y
1	11	33.03465031	14.06651739
2	9	9.304041817	15.26529007
3	11	35.00187268	46.77105185

For this task can be predicted that there will be a shift position change centers and the number of points assigned to the centers. This prediction is confirmed by calculation and graphically shown in Fig. 8.

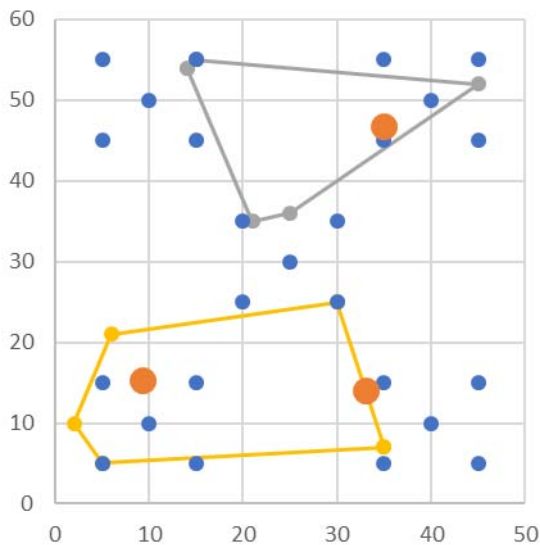


Figure 8. Result of optimization test B-1

3.2.2 TEST B-2 (3/25 CWR)

This task combines center capacity and point weight and adds work with areas. The maximum capacity is set for the centers, i.e. the sum of the weights of the assigned points, all three centers must lie outside areas A and B. The optimization conditions and the result are in Table 11.

Table 11. Results of test B-2

Number of centers		3	
Number of points		25	
Capacity of centers		All centers have a maximum allowed capacity (sum of weights of assigned points) of 11.	
Number of centers in areas A,B		0	
Total distance		426.1972904	
Center	Sum of weights of assigned points	x	y
1	11	24.36114487	29.68105772
2	9	30.17352628	53.51005192
3	11	36.25803366	6.988918277

For this task can be predicted that there will be a shift position change centers and the number of points assigned to the centers. This prediction is confirmed by calculation and graphically shown in Fig. 9.

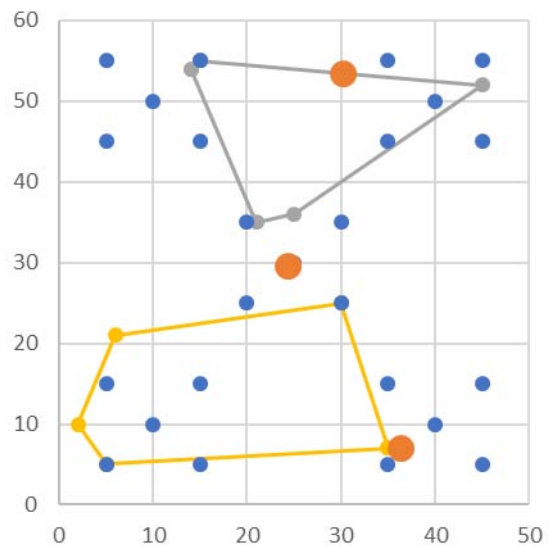


Figure 9. Result of optimization test B-2

3.2.3 TEST B-3 (3/25 CWAR)

This task combines center capacity and point weight and adds work with areas. The maximum capacity is set for the centers, i.e. the sum of the weights of the assigned points, one center must lie into area A and two into area B. The optimization conditions and the result are in Table 12.

Table 12. Results of test B-3

Number of centers		3	
Number of points		25	
Capacity of centers		All centers have a maximum allowed capacity (sum of weights of assigned points) of 11.	
Number of centers in areas A,B		Area A - 1, area B - 2	
Total distance		414.918009	
Center	Sum of weights of assigned points	x	y
1	9	8.738383737	14.06651739
2	11	32.98934049	15.26529007
3	11	35.43413036	46.77105185

For this task can be predicted, that there will be a shift position change centers and the number of points assigned to the centers. This prediction is confirmed by calculation and graphically shown in Fig. 10.

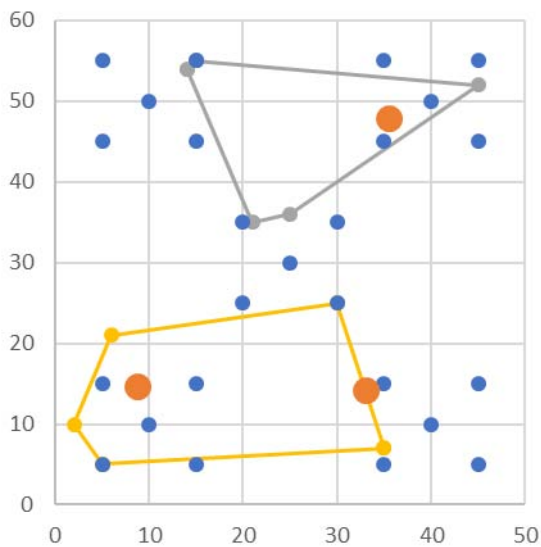


Figure 10. Result of optimization test B-3

4 Discussion & Conclusion

This article follows the original research on the possibilities of solving the MFLP problem using MS Excel software. The capabilities of solving the MFLP tasks using MS Excel were verified by metaheuristic method and published in previous research (1,2) including the influence of HW equipment and the number of repetitions of tasks on the accuracy of the results. The aim of this article was to expand the original research and to demonstrate the possibilities of solving more sophisticated MFLP tasks. The conditions for the weights of branches, the capacity of centers and their combinations were newly included in the calculation of the location of centers. Furthermore, the conditions for the location of the center in the space and therefore whether or not the center should lie in a given polygon, which is determined by semiplanes, were included in the calculation. The last complex task solves the combination of all the above mentioned conditions. The application of this method

was demonstrated in the military environment in supporting the commander's decision-making process in planning the deployment of logistical support for artillery units. All tasks indicate the expected results, thus the conditions were fulfilled, which were set out in the assignment. This method has its liabilities, which were explained in more detail in previous research. These liabilities result from the iterative process of generating random numbers and subsequently obtaining the resulting value of the location of the centers. Naturally, the evolutionary calculation, as Excel itself refers to it, is also challenging for HW equipment, which has an influence on the resulting values. For these reasons, 100 calculations were performed for each test to partially eliminate these effects. Assuming knowledge of these liabilities, it is then possible to obtain valid results, which can be in close proximity to the optimal solution. The article has the ambition to show the advantage of the solution of the optimization task MFLP with the help of the widely available Microsoft Excel software, where it is relatively easy to implement the limiting conditions of the solution and can be used in common practice.

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Primary Paper Section: K

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SIMULATION TECHNOLOGY IN THE TRAINING APPLICATION OF CADETS

^aLUDEK RAK, ^bJIRI NEUBAUER, ^cJAN HRDINKA,
^dLUDVIT HRADSKY

^{a,b,c,d} *University of Defence, Kounicova 65, 662 10 Brno, Czech Republic*

*email: ^aludek.rak@unob.cz, ^bjiri.neubauer@unob.cz,
^cjan.hrdinka@unob.cz, ^dludovit.hradsky@unob.cz*

This paper was developed as part of a long-term strategy for the organization's development Land operations.

Abstract: This manuscript presents the results obtained in a study of the importance of a system based on live simulation resources in training Defence University students in combat drills. This training is essential for understanding how to conduct combat operations and how the commander should manage the activity. In confronting the considerable sums spent on the acquisition of modern simulation systems, a research question was formulated to ascertain the impact of these resources on the educational process. The results of the research will be used as an important argument for the level of application and possibly further acquisition of systems. A research sample of almost 200 students was used for the research. The results were statistically processed and conclusions were formulated and discussed. The main result of the article is the statistical difference found between the units using the means of live simulation and the lower results of the groups that did not have these means during training.

Keywords: Artificial Intelligence, Live-Simulations systems, Military Education, Small Unit Tactics,

1 Introduction

Most advanced militaries are gradually increasing their acquisitions in various simulation technologies. Recently, these have not been limited to relatively simple means designed for training drivers or pilots of military aircraft, but also in the field of the first aid (Hatala, et. al. 2005). Constructive simulation systems in the context of (Kyungeun, Gene and Rabelo 2020) and more broadly in (Taura et. al. 2012) designed for training of staffs (Hubáček, Vráb, 2017) and larger units have been successfully used in the Central European environment for the last few years (Šimic 2012). However, modern simulation systems are finally being purchased for ground troops by SAAB (SAAB 2022), which enables training not only for individuals but even for entire combat units. With a focus on the unit's actions in a specific terrain against a specific enemy. The previous variant of this simulator was the MILES (Multiple Integrated Laser Engagement Systems) system (introduced in the Army of the Czech republic in 2002), but it did not achieve the required level of effectiveness in supporting training evaluation (Choi and Changbeom, 2015). The hits captured and evaluated by the system were rather an exception, so if the gunner hit the weapon, the system reported an error. The low battery life was also a problem; the ergonomics of the system really only met basic user requirements. The device was unable to distinguish the effects of various weapons that are now fully simulated by the system, including, for example, artillery fire - area effect in a defined space, or the effects of minefields (Hodický, et. al. 2016) Moreover, the feedback learning and broad-spectrum geolocation-based action evaluation was completely unrealistic with the original system (Borthakur, Pranjali, 2013). The system could not process the data. More broadly described in (Buontempo et. al. 2006).

Although the application of the simulators still poses some ergonomic challenges for soldiers, especially when used for extended periods of time, this is completely offset by the excellent immediate feedback that the equipment provides. The data collection and battery life is sufficient for the implementation of intensive training even over several days. The number of operating personnel is minimal, as is the time for applying the system to training. Data collection directly from the field can be implemented quite well and without loss, even with the ability to capture activity in space and time over several square kilometres.

However, the value of using live simulation systems, and in particular the increase in training effectiveness, has so far been rather estimated, and this is especially so in the context of the

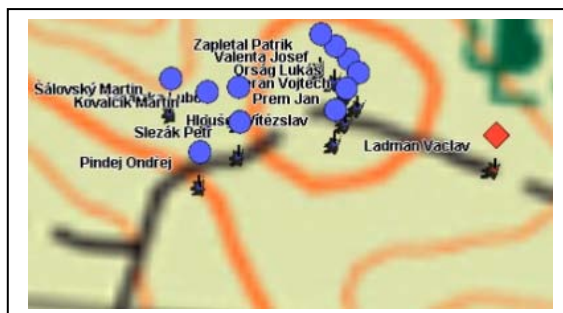
necessary robust control sample that is required to monitor group development and the increase in synergies among members of small tactical teams (Griffith 1988), (Baker, Salas 1986). Until now no one has published, even in closed military information databases, the exact data that could be used to argue for the use of these systems.

The article is focused on the publication of experimentally measured data in a direct relation to the evaluation of the effectiveness of simulator-supported training and its confrontation with training without the use of simulation technology. Its basic thesis is to answer the question: "Is there a statistically measurable relationship between the increase in training effectiveness in direct relation to the use of simulation technology?"

1.1 Technology of Live Simulation

Simulation technologies have been tied to the training of soldiers for quite some time. (Samčović, 2018), (Fletcher, 2009) Their benefits of being able to simulate lethal injuries in a non-lethal manner is a clear and unique benefit. (Smith, 2010). The live simulation system that is part of the experimental investigation belongs to the category of Tactical Engagement Simulation (TES) based on the principles of (Zeigler, Praehofer, and Kim 2000), which allows dismounted or mounted soldiers on vehicles to simulate the effects of direct and indirect fire. In addition to the Czech Army (Mazal et al. 2022), SAAB laser simulators are used by British, Swedish, German, Norwegian, Dutch, and United States forces. The system is conceptually designed as a standard tactical and marksmanship simulator for NATO units (Bekesiene and Prusevicius, 2020), for both armoured vehicles and infantry and anti-tank weapons. The system operates on the principle that an array of sensors reads laser signals initiated by the firing of training munitions (no projectile, they only have an acoustic and pressure pulse in the barrel) and evaluates the accuracy and effectiveness of individual hits. Based on the evaluation, the trainee soldier is then either taken out of combat as dead, marked as wounded including the zone where he was hit, or the vest signals the close impact of the missile by the characteristic sound of the incoming missile. Additionally, the system can assign wounds across the board or take soldiers out of combat in a specific space and time - which is determined by simulating a minefield (where soldiers enter) or an artillery barrage, which is usually indicated to soldiers by the explosions of simulated munitions. The recording of the entire combat action, each shot and missile direction, storing data on who fired, when, from where, where, and with what effectiveness, and the movement of the soldiers from the point A to B, and at what speed the soldiers moved can be used for deeper analysis after the combat action has been executed. A recording of the entire event can be projected in real time, accelerated, and synthetic data from the simulator (see Picture 1) can be used to provide total ammunition consumption, total aggregate firing effectiveness, etc. The system can process over four hundred events per second and provides a reliable transfer rate against loss of secure data. In addition, the simulator has a degree of connectivity and can interact with the VBS-4 virtual simulator, etc. (SAAB, 2022).

Picture 1: Record from the SAAB System



Source: Author – The Screenshot from SAAB Simulator

2 Methodology

The research was conducted in March 2022. The control sample (Krč 2019) was a set of first-year students of the Faculty of Military Leadership divided into a total of 38 combat groups (Small Assault Unit/Teams), hereafter referred to as SAT, four of which were equipped with the SAAB system. The individual soldiers were divided into groups and the SAAB systems were assigned to the groups in a deliberately randomized fashion. Among the other things, this was to counteract any potential biases discussed in the paper (Brown et. al. 2009) The number of groups working with simulation technology support was determined by technical constraints in relation to weapons and ammunition quantities and the number of simulators purchased. However, no circumstance such as age, gender or other factors played a role in the creation of the SAT. The specific characteristics of the research sample were:

- Age of the subjects (between 19 and 29 years old);
- Education (first year university students with a high school degree),
- Professional experience (all of them were members of the armed forces with up to one year of service who had undergone the same previous military training);
- Medical condition (without any limitations enabling full training to be carried out);
- The same equipment and equipment;
- The same methodology, sequence and didactics of training;
- The same weapons and ammunition for the implementation of training and control measurements for all SATs.

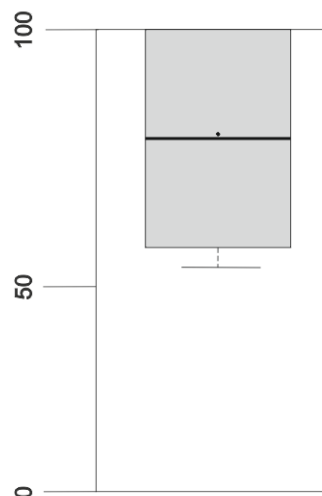
The characteristics of the research sample were determined to eliminate as much as possible the various variables that would be relevant to the outcome and would interfere with the reliability and significance of the conclusions for the base sample.

2.1 Motivation of the Research sample

Research on students' motivation to train was developed using the findings of see (Woogul, Johnmarshall 2012). The research sample consisted of soldiers included in "Generation Z" without exception (Pelech, Holendova 2022). These soldiers require the use of somewhat different methods and means of training for effective teaching, (not least with regard to the impact of the COVID-19 anti-epidemiological measures that affected their training) - see (Cahoon et. al. 2017) for a broader context - than previous generations in the Czech Republic. These were typically shaped by structured teaching methods, particularly in the direct context of frontline teaching. The subject matter, practices and teaching methods in the 'Preparation in the Field' course where the research was conducted. It has been prepared for the research by the application of modern teaching methods, gamification (Rivera, Garden 2021) of training, design-thinking (Tuckwell 2017) applied in partial parts of the training cycle. The questionnaire survey presented to the students during the research showed that 79% rated the training as very interesting and no one in the research sample rated the training as uninteresting or boring and would give it less than 50% on the 100% scale assessing the stimulation to the results see Figure 1.

This ensured that the soldiers had sufficient stimulus for personal motivation, which is absolutely necessary for the implementation and especially the formulation of conclusions.

Figure 1: Motivation of students in research

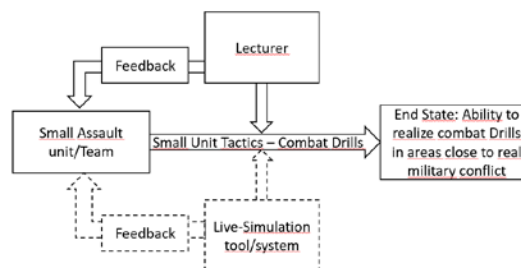


Source: Author

2.2 Realization of the Experiment

The overall training was carried out in the same premises, weather conditions, with identical provision of food, water, sleep and other influences on SAT. The training management and methodology was in charge of one particular person, and the implementation of the training was carried out by the instructors who were identically trained in the subject matter. The system of influence on students during the training is depicted in the following diagram:

Figure 2: Methodology of Education Effect to SAT



Source: Author based on his prior research

Before the training started, the soldiers went through a course (before they were divided into groups) that explained the theoretical aspects of the issue. Already in the previous, conducted research the authors of the article concluded that the training system and the capabilities of the simulator do not yet allow to exclude the instructor who teaches the soldiers the practical implementation of all aspects of the training. Thus, in the training phase, the simulator becomes just another feedback element for the students. However, with somewhat specific feedback that the instructor is unable to provide and is therefore unique. Taking the instructor out of the training cycle would only be possible if the simulator possesses a very advanced artificial intelligence and discrimination capability in the field, incorporating all the influences such as scrub, fog or otherwise reduced visibility, as well as a mode of command (Baker and Salas 1997) and communication in the unit that usually does not rely on verbal communication but on the displacements of the battle signals issued. This would present an extreme amount of data and deep analysis in context, which is currently impossible.

However, it is not possible to provide soldiers with overall feedback on whether they are engaging the enemy or how effective their fire is without the application of a simulator. The instructor see (Barron 2014) of the training tries to convey their experience and explain to them what they are doing right or wrong, but real feedback on the results of the firing does not exist.

Although one of the tools used in training is practice ammunition that forces soldiers to work with the sound, flash effect of firing, or recoil effect and the need to reload magazines, the assigned instructor cannot convey feedback on the effectiveness of firing.

3 Results

After the completion of the training, a control test was implemented for the entire research sample based on the assessment of the achieved abilities of all 38 groups by a group of experts. During this control test, the soldiers no longer used the simulation system. The simulation was therefore only available during the training itself, when the soldiers were acquiring and learning knowledge and skills important for conducting combat operations. During the control test, the soldiers did not have the opportunity to interact with the experts. They came to the individual control test sites randomly. Thus, the experts did not know whether this particular unit had been trained with the SAAB system or not. The results of the groups are shown in the following tables.

Table 1: Descriptive charaktristic for no SAAB support SAT

Type of Assessment	n	Mean	St. Dev.	Median	Min	Max	Q _{0.25}	Q _{0.75}	Skewness	Kurtosis
Weapon Handling	34	1,118	0,537	1	0	2	1	1	0,110	0,149
Reaction	34	1,382	0,779	1	0	3	1	2	0,008	-0,564
C2	34	1,324	0,878	1	0	3	1	2	0,124	-1,004
Maneuver	34	1,794	0,808	2	0	3	1	2	0,034	-0,935
Aggressiveness	34	1,676	1,806	2	0	3	1	2	0,058	-0,644
Reaction Speed	34	2,647	1,412	3	0	5	1	3	0,072	-0,700
Drills	34	4,382	0,985	5	0	5	4	5	2,634	8,838
Shooting Training	34	4,074	0,740	4	2	5	3,5	4	0,463	-0,807
TOTAL	34	18,397	2,007	18,5	0	22	17,125	22	0,299	-0,496

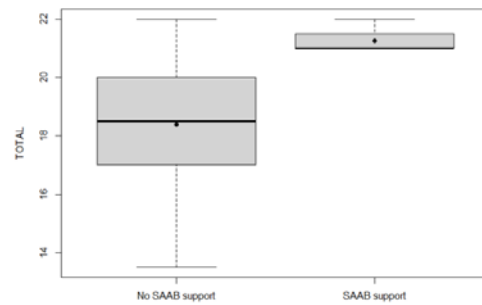
Table 2: Descriptive characteristic for SAAB support SAT

Type of Assessment	n	Mean	St. Dev.	Median	Min	Max	Q _{0.25}	Q _{0.75}	Skewness	Kurtosis
Weapon Handling	4	1,000	0,817	1	0	2	0,75	1,25	0,000	-1,875
Reaction	4	1,500	1,291	1,5	0	3	0,75	2,25	0,000	-2,078
C2	4	1,750	0,500	2	1	2	1,75	2	-0,750	-1,688
Maneuver	4	1,750	0,500	2	1	2	1,72	2	-0,750	-1,688
Aggressiveness	4	1,750	0,957	1,5	1	3	1	2,25	0,320	-2,084
Reaction Speed	4	4,000	1,155	4	3	5	3	5	0,000	-2,438
Drills	4	5,000	0,000	5	5	5	5	5	---	---
Shooting Training	4	4,500	0,577	4,5	4	5	4	5	0,000	-2,438
TOTAL	4	21,250	0,500	21	21	22	21	21,25	0,750	-1,688

Students were successively tested in eight individual areas in which they were trained during the training. Each individual area was monitored and evaluated by one selected expert (from a different organisational unit of the Ministry of Defence) with real combat experience or experience comparable to combat experience from direct deployment in a foreign operation. In addition, each area evaluated was assigned an appropriate weight by the training author to reflect its importance to the overall required training output.

The overall result is displayed using a boxplot. This shows the maximum and minimum values, the upper and lower quartiles and the line in the middle of the boxplot represents the median. The point in the diagram then shows the arithmetic mean.

Figure 3: Total Results Shown in the Graph



Source: Author

The graph above shows the importance of the SAAB system and the significant increase in SAT capability that practiced with the support of this technology. Before comparing the groups, a normality test of the data was performed. Due to the small size of the data in the SAT group that practiced with the support of the simulation technology, the Shapiro-Wilk test was used. (Values are shown in the table.) The italics indicate p-value results less than the 0.05 significance level. These values indicate that, in most cases, the data cannot be considered a random sample from a normal distribution.

Table 3: Shapiro-Wilks Test

Type of Assessment	No support	With support
Weapon Handling	0	0,68300
Reaction	0,00047	0,97190
C2	0,00048	0,00124
Maneuver	0,00034	0,00124
Aggressiveness	0,00065	0,27250
Reaction Speed	0,00012	0,02386
Drills	0	X
Shooting Training	0,00993	0,02386
TOTAL	0,73950	0,00124

Table 4: Statistic Difference (TOTAL)

Statistic Difference	p-value	Difference
Weapon Handling	0,74921	NO
Reaction	0,85860	NO
C2	0,33347	NO
Maneuver	0,97960	NO
Aggressiveness	0,97968	NO
Reaction Speed	0,07775	NO
Drills	0,10451	NO
Shooting Training	0,29566	NO
TOTAL	0,00486	YES

Due to the fact that the data cannot be considered as a sample from a normal distribution, a non-parametric test - the two-sample Wilcoxon test - was used for further analysis. The results clearly showed no statistical difference for individual partial scores between the set using the SAAB technology and the set of groups that did not use this system. However, a statistical difference was demonstrated in the overall scores. Thus, a clear conclusion can be drawn that this technology has relevance in training, which can be argued by the statistically evaluated results. Thus, the simulation technology used is significant in the educational process of soldiers and demonstrably makes it more effective. Thus, its use during the activity of the units clearly contributes to the increase in the capabilities of the teams. Although it cannot be said that it uniformly increases all assessable aspects, overall there is a clear significance.

4 Discussion

The stated research question has been answered. In any case, the fact that the partial aspects evaluated did not show a statistical difference creates the question of how and to what extent each of

the partial aspects is stimulated by the simulation technology. Thus, it opens the space for further and deeper research in this area of soldier education. Moreover, not all assessable aspects were included during the examination, but the individual group-sections do exhibit them. One example is the synergy in the unit, etc. Thus, in order to comprehensively express the effect of the simulator, it is necessary to conduct a series of sub-analyses and deeper analyses to identify all the links and the effect of the application of this technology in the training system. Nevertheless, as a pilot study, it is of great importance, especially in the question of further purchases of live simulation resources (at a total cost of more than 3 million EUR), the justification of its application in training plans and the definition of areas for further research.

4.1 Limitations for the Research

The research was limited mainly in the number of research samples using simulation technologies. This limitation is mainly due to the material availability of the technological elements themselves and the impossibility of installation on different types of weapons currently introduced into the Czech Armed Forces. However, with time and further acquisitions, the importance of this aspect will prospectively decrease. In training, students use off-the-shelf types of weapons, which will be replaced by new models in the medium term. Another significant limitation is the fact that one research element is represented by a group of five soldiers. This is quite demanding with regard to the material, and the dependence on the material increases significantly with each additional sample. Almost 60,000 training rounds for different types of weapons were allocated for the implementation of this training. The entire training for the unit lasted more than 12 days, and the soldiers were in continuous training mode, which means that they were training 12 to 15 hours a day. Also in light of this fact, the findings represent a unique landmark in arguing for the further development and application of live simulation tools to training and their gradual integration into robust simulation systems.

4.2 Impact of Results – Findings

The authors see the importance of the results especially in their uniqueness. Research on the effectiveness of simulation technologies used in SAT has not been carried out to this extent and with subsequent statistical data processing not only in the Czech Republic, but also in the Central European region or even in the European region. The use of simulation technologies in many areas of human cognition and especially in the educational process is quite common. However, in the military and specifically in the activities of ground combat units, it is still a relatively innovative and even unique solution in smaller armies. The multitude of influencing factors rebuilt by multiple soldiers' abilities in the areas of battle management, information transfer and command skills, ability to conduct accurate fire, rapidly reload magazines, and provide sufficient cover and concealment in varying terrain conditions under varying visibility presents a very challenging process for providing feedback. Currently, it is not possible to use a simulator alone without significant instructor support, as the actions of a small infantry unit are dependent on a large group of variables and unfortunately are also heavily influenced by chance. Nevertheless, it has been clearly confirmed that the correct application of simulation technologies brings clear results and makes the educational process of the unit more effective. Thus, this research clearly argues for the use of simulation technology with concrete statistical results and, through the use of a large research sample and a large amount of material (especially ammunition), presents a clear argument for the use of simulation technology while shaping the next direction of research. And, more broadly, it corresponds with the results of (Eldad and Kalderon 2013). In particular, as one of the key factors influencing the effectiveness of small unit combat is capability in the area of leadership, which is also strongly supported by the results of the use of simulation technology. In this area, research more broadly corresponds to the theses of (Polmear 2022).

4.3 Ethical Statement

This research was carried out in accordance with the 2018 European Research Council guidelines. Permission to carry out the research project was obtained from the programme supervisor and the supervisor of the "Preparation in the Field" course in which it was carried out. Participants were provided with all relevant information about the research objectives, participant anonymity, data collection, data storage and further analysis. Participants had every right to withdraw from the study and signed an informed consent to participate in the research.

5 Conclusion and Future Research

In conclusion, it is necessary to state that the results obtained during the implementation of the research will generally become the starting point for follow-up research activities of the authors in the field of education of small military units. Uncovering the deeper links between individuals and determining the weights of each of them, along with understanding the most important desired characteristics of each of the warriors relevant to the conduct of combat and, in particular, to the effectiveness of the entire SAT, is very important for the further development of this field. It will bring the opportunity to focus on the most important aspects of training and developing those components of combat that are most important to the target state. The requirement for the application of effective simulation technology is the cornerstone of all this activity. Only through in-depth analysis and back-testing will it be possible in the future to implement another branch of simulation technology in the form of the application of advanced artificial intelligence, cf. (Landsberg et al. 2012), which will allow the replacement of the so far necessary feedback element in the form of the training instructor. Without exact data on whether the enemy has destroyed the SAT, or the SAT has eliminated the threat in the form of the enemy, or effectively disengaged contact with the enemy, it has not been possible to realistically prepare units for combat operations at all to date. Training was based on experience and existing proven principles, applying established Tactics, Techniques, Procedures (Spilý and Hrnčiar 2013), (Spilý and Hrnčiar 2022). The possibility of evaluating enemy interventions was only in the realm of imagination. At the same time, the ambition of SAT training is not only to prepare effective combat groups, but to gradually supplement them with additional elements in the form of robotic systems with a formulated degree of application of artificial intelligence capable of further increasing the capabilities of the teams and their effect in engaging the enemy. This is either by simply reducing the SAT's weaknesses - in the area of command, or early recognition of the enemy, but also in the area of increasing its advantages - enabling a faster attack, greater coordination of command, or an increase in the firepower of the attack.

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