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# AD ALTA: JOURNAL OF INTERDISCIPLINARY RESEARCH

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# MASS MEDIA VS. PUBLIC AND NATIONAL SAFETY

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Abstract: The media have become an integral part of the social life. They have an enormous impact on it. However, they occasionally may be harmful, or even – more or less consciously – their actions may lead to various distortions of the public and national safety. Under what circumstances would be such a situation possible to occur? How to prevent it? This article contains answers to those questions.

Keywords: media, terrorism, threats, information security

The contemporary society is becoming the information society[1] – information, gaining it (or hiding), the speed of processing are getting a greater significance. Undoubtedly, the mass media have a leading role in the transmission of information nowadays. Nevertheless, their role in the society is not limited only to inform.

**Media – functions and mechanisms of action**

The media shape opinions, additionally, they are the place of public debate on significant topics and play educational and entertaining functions. For media owners, the economic dimension is also vital: the media, are to make profit by fulfilling their tasks. This profit usually has its source in charges for using the content (selling newspapers, subscriptions, etc.) and income from ads. Therefore, more and more media content is determined by commercial factors[2].

Although the media themselves constitute the neutral tool that can be used for good or evil purposes, it must be remembered that the content of the media coverage depends on many factors (the aforementioned economic aspect is only one of them). First, the media content is shaped by real people who have their own views and opinions. Therefore, the total objectivity, even in the pure information, remains rather an unattainable ideal. The same selection and statement of publicized facts is already a form of commentary as well as the amount of space devoted to a particular event. A journalist becomes a gatekeeper. In other words, certain topics can be publicized by the media and fanned artificially, while others – sometimes having a much greater significance – muted and marginalized[3].

**State and media**

The media relations with the world of politics and the state authorities in general are also worth mentioning. There exist various approaches and media doctrines – from the totalitarian doctrine, where the media are nearly a part of the apparatus of power and a tool of propaganda, through the liberal one and to

the doctrine of social responsibility[4] – which most frequently features democratic societies.

The media system is a complex organism, which normally is under pressure of various factors including the state, society and market. In general, the media system in the state is a reflection of the social and political situation. Diverse external (especially the socio-economic conditions), legal, political and constitutional factors shape the media system and influence its efficiency. And conversely, the media are important for the state policy and understanding of the public interest. They also educate the society, which would be active in public life, according to axiology and a sense of national identity. State action should also be designed to defend freedom of expression and information, media diversity, protection and development of the domestic market and audiovisual production and also protect competition and structural pluralism of the media (a situation of over-concentration of the media ownership – especially in the hands of a foreign capital – is not acceptable from the standpoint of the national security). In Poland, these issues are regulated by the Act on Protection of Competition and a Consumer and other acts, which aim to prevent the situation where one entity has a dominant position on the media market (over 40% of the market share)[5].

**Media vs. information security**

The media business is closely related to the concept of information security, understood (in negative terms) as the 'protection of information against unauthorized (accidental or deliberate) disclosure, alteration, destruction or preventing its process'[6]. However, the negative approach of information security may not be sufficient in regard to the growing importance of information. At this point, essentially each area of national security is becoming increasingly dependent on the free flow of information and the action of systems based on information. The army, economy, energy, media, financial and transportation systems are particularly vulnerable in this respect. As P. Paleri states, "freedom of information does not provide the right to a person to demand all information connected with the state. There is information that may prejudicially affect the elements of national security if made open"[7]. Thus, it is necessary for national security to introduce such an information security policy, which would ensure the protection of the existing systems and offer a guarantee of survival and freedom of development of the 'information society'[8].

It must be remembered that information is a strategic asset of states and organizations of the twenty-first century and knowledge and technologies resulting from it will become the basic factor of production. Decision processes in other sectors of economy and social life even more will depend on systems of processing and transmitting information, whereas a disruption of the proper functioning of information – control systems does not require high inputs of material.

Therefore, it should be expected that the competition between opponents would be transferred to the area of the information struggle, which is connected with the armed battle in the

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[1] Umesao Tadao, a Japanese journalist, is considered the author of the term 'information society'. In his article published in 1963, Tadao wrote about the society based on information systems. Interestingly, he never used the term 'information society' in the article directly, however, his ideas became popularized. Currently, there are numerous definitions of the information society. The differ since the phenomenon of the information society is recognized in terms of various sciences: sociology, computer science, etc. Cf. I. Merklejn, *Teoria społeczeństwa informacyjnego Umesao Tadao i jej znaczenie dla dalszych badań*, in: P. Francuz, S. Jędrzejewski (ed.), *Nowe media i komunikowanie wizualne*, Lublin 2010, p. 13. According to the report of IBM Community Development Foundation, the information society features the high level of the information usage in everyday life by most of the citizens and organizations and the use of the uniform or compatibile information technology for a personal, social, educational and professional use, and additionally, the ability to transmit and receive digital data regardless of distance. Cf. M. Nowina Konopka, *Istota i rozwój społeczeństwa informacyjnego*, in: T. Białobłocki et al., *Społeczeństwo inform@cyjne – istota, rozwój, wyzwania*, Warsaw 2006, p. 15.
[2] Cf. *Funkcje komunikowania masowego*, in: W. Pisarek (ed.), *Słownik terminologii medialnej*, Kraków 2006, pp. 62-63.
[3] More cf. M. Kunczik, A. Zipfel, *Wprowadzenie do nauki o dziennikarstwie i komunikowaniu*, trans. J. Łoziński, W. Łukowski, Warsaw 2000, pp. 105-148; P.J. Shoemaker, T.P. Vos, S.D. Reese, *Jornalist as Gatekeeper*, in: K. Wahl-Jorgensen, T. Hanitzsch, *The Handbook of Journalism Studies*, New York-Abingdon, Routledge, 2007, pp. 73-86.

[4] More cf. T. Goban-Klas, *Media i komunikowanie masowe. Teorie i analizy prasy, radia, telewizji i Internetu*, Warsaw 1999, pp. 158-173; C.G. Christians et al., *Normative Theories of the Media. Journalism in Democratic Societies*, University of Illinois 2009.
[5] Cf. A. Adamski, *Kto i jak na kogo wpływa, czyli o wzajemnym przenikaniu mediów i polityki*, „Cywilizacja" 2011 no. 39, pp. 20-28.
[6] K. Liedel, *Bezpieczeństwo informacyjne jako element bezpieczeństwa narodowego*, „Krzysztof Liedel - a private website" (November 27, 2008), http://www.liedel.pl/?p=13 (accessed May 7, 2012).
[7] P. Paleri, *National Security. Imperatives and Challenges*, New Delhi 2008, p. 283.
[8] National security is one of the circumstances that permits government censorship via prior restraint. The example can be the right to restrain speech about military activities during times of war. Cf. J. Turow, *Media Today. An Introduction to Mass Communication*, New York-Abingdon 2001 (4th edition), p. 82. An alternative to government censorship is government secrecy. But it is important to note that in USA secrecy regulations applies to government officials, not to mass media. If journalists find out these secrets and decide they should be published, they could not be punished. But the officials who allowed the secrets to become known could be penalized. Cf. R.E. Hiebert, S. J. Gibbons, *Exploring Mass Media for a Changing World*, Routledge 2000, pp. 92-93.

doctrines (and in future may become a substitute for a war)[9]. Hence, in certain situations the media can be a tool of destabilizing security of information by the hostile factors, for example:

a. The media may be used by the enemy as a tool of disinformation, spreading public concerns (especially, if hostile states would manage to cooperate with more significant persons from the media world and would make them their agents). In broad terms, disinformation is the 'component of the information war techniques, using such methods of influence on a recipient as: a trick, intoxication (addressed to the elite, using the point lies), white propaganda, black propaganda, influencing'[10]. K. Liedel warns that 'modern IT weapons create new opportunities for taking successful operations that are aimed at controlling the opponent's decision-making processes, even on a national scale. The introduction of multiple sets of carefully selected real and false data to public and latent information systems can create public sentiment and a political climate, which, as a result, will make decisions consistent with the expectations of the perpetrators of these manipulations'[11]. Therefore, "informational security is not safeguarding information alone. It also has to take care information overload and misinformation based on psychological operations and information warfare whether covert or overt"[12].
The media, by pursuing news, also become (sometimes unconsciously) prone to disinformation of special services and turn into a tool of competition between them or an instrument of a foreign intelligence service wishing to cause the internal instability and lead to internal and international tensions by a particular publication. The unreliable relation entails negative consequences. They will be more serious, the more difficult situation they concern. The scale of damage also depends on the effect which such a situation may have on the whole society, its further development and security. These dangers pose any type of disaster, especially related to public safety. On the one hand, they require the immediate response from the media, however, on the other hand – the ability to refrain from formulating opinions too early, until all facts will be disclosed and all parties will present clear actions. Unfortunately, the modern media wishing to gain the advantage over their competitors, oftentimes publish sensational materials and do not consider the results of too early disclosure. The crisis, therefore, offers an enormous opportunity to increase the popularity of the medium. If its leadership gives in to this temptation, then, a reader or listener, instead of reliable information, will receive a false picture of reality created as a result of the so called 'news creation'[13].
It is also possible to erode the authority of the country on the international stage by controlling the media publications in the neighboring countries[14]. To some extent, it results from globalization and a greater mutual 'penetration' of cultures, countries and societies. This openness of countries and societies, on the one hand, stimulates their development, but on the other – is the source of their vulnerability and sensitivity to the external impacts. It manifests itself in the increase of mass communication, which extends to many areas of life – from the economy to culture[15].

b. The excessive portrayals of violence in the media may affect the sense of security among citizens in a negative way. Undoubtedly, 'the information targeted at the society may affect a sense of security of recipients, especially in the area of public security'[16]. Not only it applies to situations when the media talk about attacks or present different form of violence. It

may also refer to a broadcast of arrests and detentions of public figures, which may be perceived as a political battle by the society, and thus, increase uncertainty and a sense of instability[17]. According to H. Karp, we can talk about the phenomenon known as media terrorism, which is manifested in intrusive images, saturated with violence and aggression. Media terrorism, i.e., media transfers, ruin lives of not only individuals and communities, but also entire nations and cultures[18].

c. By disclosing state secrets, which are significant for the state defense or its prestige, the media may weaken public and national safety and evoke anxiety among people. Sometimes, the disclosure of such secrets may occur randomly (e.g., Google Maps users have recently discovered the U.S. secret air base at Yucca Lake, Nevada on satellite photos)[19], and sometimes may result from carelessness and lack of responsibility of journalists, and sometimes it can be an intended activity. However, there are situations when the media restrain from certain topics in the name of responsibility for the state defense or prestige. For instance, the case of the alleged CIA prisons in Poland, which was rather omitted in the Polish media. This issue is discussed in the journalistic business from the standpoint of the journalistic ethics, however, it is assumed that such an attitude of the Polish media proves their sense of responsibility for the safety and prestige of Poland (the responsibility for the national safety prevailed requirements of the journalistic ethics)[20]. It is worth remembering that this is not just about the prestige of Poland, but also about exposing the country to a retaliatory attack from terrorists (which is of particular importance at least in the context of EURO 2012).

d. The media can be used by terrorists – directly as a tool of communication, or indirectly – the press by publishing information about attacks calls public opinion against the government (e.g., Spain, where a terrorist attack caused that the ruling party lost the election)[21]. However, the issue of the cross-references of the media and terrorism is much broader and the provided example is just the proverbial tip of the iceberg. The war on terrorism is in fact the example of the so-called 'asymmetric warfare' translated into 'the armed conflict, in which a country or a group of countries are facing a confrontation with the enemy, whose international status, structure and objectives are beyond the semantic scope of a concept of a conventional war'[22]. In the asymmetric conflict, one party of the confrontation is unable to oppose the enemy in a symmetrical manner, i.e., using the same or similar means of warfare. Therefore, it choses such a field of confrontation that can be frequently characterized by the low expenditure compared to the media, social and political effects. The asymmetric threats are characterized by the uniqueness, surprise and a blow into the most sensitive cells of the state and trans-state structures, with the simultaneous low-financial expenses[23]. As K. Liedel notices, terrorism is a kind of a theater, whose message is directed not so much at the victims of the attacks, as at those, who hear about the attacks in the media and begin to feel fear themselves[24]. One of the Polish prime ministers, during a conference on media and terrorism said: 'An act of terror lacks a broader meaning if there is no promotion in the media. Anonymity kills terror and takes it meaning. Therefore, terrorists skillfully use the logic of the media – their mission to provide information and present reasons. Besides, terror and acts of destruction represent the attractive topic – terrible news sell well and result in the increase of the circulation and viewership. Tragedy brings in money. Thus, terrorists use the media,

[9] Ibid.
[10] H. Karp, *Wokół zagadnień terroryzmu medialnego*, „Cywilizacja" 2001 no. 39, pp. 31-32.
[11] Cf. K. Liedel, *Bezpieczeństwo informacyjne*…, quot. art.
[12] P. Paleri, *National Security*…, quot. jour., p. 283.
[13] Cf. A. Osińska, Afganistan. *Konflikty wojenne w mediach - aktywizacja mediów*, „Reporterzy.info" (a publication date is missing), http://www.reporterzy.info/318,afganistan-konflikty-wojenne-w-mediach---aktywizacja-mediow.html (accessed May 7, 2012).
[14] Cf. K. Liedel, *Bezpieczeństwo informacyjne*…, quot. art.
[15] Cf. R. Kuźniar, *Stosunki międzynarodowe – istota, uwarunkowania, badanie*¸ in: E. Haliżak, R. Kuźniar (ed.), *Stosunki międzynarodowe – geneza, struktura, dynamika*, Warsaw 2000, p. 22.
[16] Cf. J. Mazur, *Bezpieczeństwo publiczne w prasie – wstęp do problematyki*, in: M. Gawrońska-Garstka (ed.), *Edukacja dla bezpieczeństwa. Bezpieczeństwo intelektualne Polaków*, Poznań 2009, p. 149.

[17] Cf. ibid., pp. 149-150.
[18] Cf. H. Karp, *Wokół zagadnień*…, quot. art., p. 31.
[19] Cf. J. Brandon, *Are These Satellite Images Exposing America's Secrets?*, "Fox News" from December 10, 2011, http://www.foxnews.com/scitech/2011/12/10/could-google-reveal-secret-spy-drone-lost-in-iran/ (accessed May 7, 2012).
[20] Cf. M. Kowalczyk, *Racja stanu CIA*, „Press" 2010 no. 10, pp. 30-32.
[21] For a broader analysis cf. B. Dobek-Ostrowska, M. Kuś (ed.), *Hiszpania: Media masowe i wybory w obliczu terroryzmu*, Wrocław 2007.
[22] G. Pożarlik, *Bezpieczeństwo międzynarodowe w czasach globalnej asymetrii*, in: G. Babinski, M. Kapiszewska (ed.), *Zrozumieć współczesność*, Kraków 2009, p. 217.
[23] Cf. M. Bodziany, *Socjologiczny dylemat bezpieczeństwa narodowego w kontekście zmiany społecznej i wielokulturowości*, in: D. Czajkowska-Ziobrowska, A. Zduniak (ed.), *Edukacja dla bezpieczeństwa. Bezpieczeństwo regionalne – wyzwania edukacyjne*, Poznań 2008, p. 500.
[24] Cf. K. Liedel, *Wolne media a terroryzm*, „Krzysztof Liedel - prywatna strona internetowa" (December 1, 2008), http://www.liedel.pl/?p=57 (accessed May 7, 2012).

however it is also the media that use a terror'[25]. For this reason, there is a growing dilemma and conflict between freedom of expression and the right to feel safe[26].

e. the struggle in the cyberspace – hacker attacks on the government sites.

## The remedies

In connection with the aforementioned (very briefly) aspects of the impact of the media on the public and national safety, the question about the possibility to remedy such situations arises. This can be accomplished by:

a. The education of the government and administration workers in the area of the cooperation with the media, the protection of information, the information management, the media crisis management[27]. The contacts with the media, the governmental emergency tools and the public communication should constitute a key element in all kinds of antiterrorist exercises, which would be as important as the operational response, command and coordination of various antiterrorist departments[28].
b. The education of journalists in the field of the national safety issues, developing in them a sense of responsibility for the public and national interest and improving the typically journalistic workshop (such features as: reliability, the habit of verifying the information in at least two sources). The issues of the professional ethics as well as convicting the media workers to educate the society in shaping the attitudes of responsibility for the public safety and encouraging their participation in its creation, remain significant matters[29]. It is worth recalling postulates related to the media that K. Jakubowicz formulated already in 1999:
   . Do not create a forum for terrorists by quoting their manifestos and letters of requests.
   a. Do not inform about the threats against certain people.
   b. Do not give further details about public figures who could be exposed to terrorist attacks.
   c. Avoid mentioning names of victims so their relatives do not find out about their loss from the media (this rule does not apply to public figures). The media should indicate the source of information about victims and details of the attack.
   d. Do not conduct interviews with the victims of a disaster who are in shock or suffering, or with their relatives who are in mourning – without their permission and confidence that they agreed to give an interview under the influence of emotions.
   e. The first estimates of the number of victims are usually imprecise. You should be careful with their administration and, if necessary, revise them.

f. Do not re-use large parts of the direct relation from events, not to suggest that they are still ongoing[30].
c. Keeping the reasonable information policy by the state and its institutions – especially in the armed conflict situations (such as war journalists and the policy towards them).
d. Such regulations of the media that they meet the requirements of the national security. It can be mentioned: the anti-concentration rules, the imposition on journalists the duty to serve the society, the relevant regulations in the Act on Access to Information etc.[31] Generally, the doctrine might promote a dialogue between authorities and the press[32].

As can be observed, there exist numerous danger zones. The possible preventive actions are focused on the regulation and enforcement of the law as well as the educational action. They should have a dual nature so that the media people would be aware of their responsibility for the public safety, whereas the persons, who are directly responsible for this safety, would be familiar with the principles of the media and, hence, would be able to communicate with them effectively.

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[26] Cf. J. Kochanowski, *Media a terroryzm*, the Ombudsman's website, publication date is missing, http://www.rpo.gov.pl/pliki/12271025030.pdf (accessed May 7, 2012).

[27] Thus, it might be worth creating a book describing the relations with the media for such people? Such publications are issued, e.g., in the USA and Great Britain, e.g., L.M. Brown, *Media Relations for Public Safety Professionals*, Sandbury-Mississauga-London 2004.

[28] Cf. M. Żuber, *Edukacja społeczeństwa wobec zagrożenia terroryzmem*, in: D. Czajkowska-Ziobrowska, A. Zduniak (ed.), *Edukacja dla bezpieczeństwa. Bezpieczeństwo regionalne – wyzwania edukacyjne*, Poznań 2008, p. 566.

[29] The conference 'How to write about the national safety?' organized by the Institute of the Media Education and Journalism at Cardinal Stefan Wyszynski University in Warsaw (CSWU) in Warsaw in 2008, under the patronage of the National Security Bureau, can be an example of such actions. Its participants formulated the following postulates addressed to journalists, who deal with the issue of the national safety: First, a journalist, who decides to write about the national safety, should be experienced and familiarized with this matter. However, equally important to the experience is a constant self-improvement, learning new things. Moreover, a special journalistic reliability is a necessary requirement. A journalist must be very precise and carefully verify every obtained information. Then, we should also add such features as objectivity and respecting the principles of the journalistic ethics. Cf. B. Skowron, *Jak pisać o bezpieczeństwie narodowym?*, „Wiadomości24" from April 16, 2008, http://www.wiadomosci24.pl/artykul/jak_pisac_o_bezpieczenstwie_narodowym_6437 6.html (accessed May 7, 2012).

[30] Cf. K. Jakubowicz, *Zasady pracy dziennikarskiej w sytuacjach kryzysowych*, „Forum Dziennikarzy" 1999 nr 1-2, [online] http://www.sdp.pl/1999-01-02 (accessed May 7, 2012).

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**Primary Paper Section:** A

**Secondary Paper Section:** D, E, J

# INTERNAL AUDIT AND ITS APPROACH TO THE RISK MITIGATION

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Abstract: This thesis is analyzing the modern role of the internal audit in corporate (mainly banking) structures. It describes the changes made in the social role of auditing during the years and emphasizes the internal audit´s risk management function, rather than just control function. Attention is given to the methodology used, especially to the currently most widespread risk-based auditing approach. Also one of the most recent approaches to auditing – so called continuous auditing - is briefly described and the possibilities of its implementation into the risk-based framework are outlined.

Keywords: Internal audit, continuous audit, risk-based audit, compliance audit, control audit, risk management, risk mitigation, audit methodology, audit planning.

## 1 Introduction

The Institute of Internal Auditors defines the internal audit officially as an independent, objective assurance and consulting activity designed to add value and improve an organization's operations. It helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes.

Internal audit in the modern sense is a relatively new but yet an indispensable part of the corporate structure of the most of large corporations. In some areas, such as banking, its existence is based on the legislative requirements. It's a logical step as the internal audit is, due to its independence, not only an internal control tool, but also a significant assistant, a partner and a point of contact for an external regulator of the banking industry. The basic principles of the cooperation between an internal audit and a regulator are described, among others, in material prepared by Basel Committee on Banking Supervision entitled Internal Audit in Banks and the Supervisor's Relationship with Auditors. According to this document, the supervisory authority should assess the quality of the bank´s internal audit and, if the evaluation goes well, it can rely on it in identification of the high-risky areas (it can use the reports of internal audit as a source of an information about the problems of internal controls in the audited areas, or on the other hand, it can focus on the risk identification in those parts (processes) of the bank, where the audit was not conducted for a long time)). Supervisor and internal auditors should also arrange regular meetings and discussions related either directly to individual banks or only common, sector-wide issues.

This thesis is trying to analyze the modern role of internal audit in corporate (mainly banking) structures and gives a special attention to the methodology used. It also tries to bring the new insight into risk-based auditing by implementing principles of continuous auditing into risk based framework.

## 2. The social role of the internal audit and methodological approaches to its process

The various trends and opinions on the appropriate work content of internal audit and its social roles over time are not strictly separable. These trends are influenced by economic and social characteristics of the time and largely overlap each other. A characteristic feature is also a fact that these trends do not necessarily exclude each other. In general, without the strict categorization, it can be seen that in the last 70 years there was a shift in the understanding of the role of the internal audit from a kind of "external audit addition", dealing only with the financial indicators, over the assessment of the effectiveness of controls, to the audit of complex processes and finally to the role of consultative business partner and a provider of continuous and comprehensive assurance on the internal risk environment. Perhaps with the exception of the first-mentioned approach, it

can´t be said, that the internal audit as we know nowadays, does not fulfill the task.

The aforementioned trends in the economic and social role of internal audit are followed by the development in the methodological bases for which more strict classification is possible. The main methodological approaches specific for the internal audit are the compliance based auditing (sometimes also referred as a control based or transaction based) and risk based auditing (RBA).

### 2.1 Compliance / control based audit

Compliance / control based audit is the basis of methodology of internal audit. In essence it is the one of the first methodological approaches that can be considered as specific solely for internal audit (considering the modern understanding of the concept of internal audit). As its name suggests, it deals primarily with an assessment of compliancy of internal activities with the internal methodology or regulatory measures and also with the control functionality and the control implementation in accordance with the methodology or regulations. This assessment is done through the testing of individual transactions within the institution.

The drawback factor of this approach is that while assessing the existence and effectiveness of the controls, it does not examine its global impact or significance and motivations leading to its implementation. Compliance audit is therefore unable to determine whether the area is overly controlled. Compliance audit also does not concern about the rules itself; therefore it does not assess its ability to reduce risks. It is thus theoretically possible that in the audited area there are a number of risks not covered by valid methodology and required controls, and audit still does not consider this area as problematic.

The last, but not insignificant problem of this approach is that it is largely based on the transactional principle (as already mentioned, sometimes the whole methodology is called "transaction based"). This is reflected in the absence of a global perspective. Output of compliance audit can sometimes provide only sketchy information about the company's internal processes (e.g. considering an area of consumer credits, the process is not viewed as a whole - from the initial contact with the client, to the repayment, or collection process, but only as the single transaction or control – e.g. the presence of the client signature on the contract is checked etc.).

### 2.2 Risk based audit

At present, it is clearly the most frequently applied approach to the implementation and run of internal audit. This popularity is based on both a natural progression - a shift in the role of internal audit from a purely supervisory role to the role of risk-preventive tool - as well as on number of regulatory requirements – e.g. in the Czech banking sector the regulator´s decree on prudential rules for banks requires (although indirectly) to use risk-based principles in auditing when declares, that that the planning and scheduling of capacities of internal auditors is based on the risk analysis. The risk analysis performed before starting the audit work is the cornerstone of the risk-based methodology. Based on this analysis the capacities of audit teams are then redistributed with primary intention to cover the most risky areas. Individual audits are no longer run based on regular time schedule, but based on risk weights assigned to the individual areas.

Another important element of RBA is the preference of a process approach. In the literature (e.g., Griffiths (2005)) the process based audit (sometimes also known as systemic or process-systemic) is sometimes considered as a separate audit methodology. But such approach is not entirely correct. Process audit cannot be seen as a separate methodology, but as a necessary part of the risk-based auditing. As mentioned by

Stanciu (2008), risk doesn't recognize organizational charts. It doesn't confine itself to functions and units, processes and roles; it travels through the bank in an interdependent and connected way. It is therefore not safe to practice risk management on an exposure-to-exposure: risks must be recognize and managed holistically across the entire bank. Therefore, if the RBA should run effectively, it has to be applied in the process way.

What precisely does the term process approach mean? As the name suggests, the fundamental principle of process based auditing is the analysis of complex processes and systems rather than individual transactions or process parts – considering the case of consumer credits area, all the steps involved in the process of granting, approval, drawing and repayments or collections and recovery are analyzed throughout the entire bank, not only in relation to one branch (if the sample of cases from one branch is used during the testing, the conclusions are then generalized and applied on the entire bank).

But even though the process approach is strongly advised, some examples of the non-process approach to the RBA can also be found. Sharma (2004) defines it as a risk-focused internal audit and describes it on an example of the bank which divides its branches into three categories according to the amount of income produced. The riskiness (and related remedial measures like the frequency of audit inspections) is then assigned to particular branches based on this income amount.

However, as mentioned before, if the risks should be comprehensively analyzed, it is highly advisable to perform audits in the process way as it is more transparent, comprehensible and it gives an better assurance, that none of the risks was omitted due to the fact that it fell "somewhere between the focus" of the parts of the non-process audits.

 The most ideal case, however, is not the use of the RBA only. It is the combination of both the RBA and compliance/transaction-oriented audit. In such a case the audit of the transactions works as the internal part of the RBA allowing a more accurate estimate of the riskiness of individual processes. This combination, however, is very costly, as the number of auditors needed logically rises (part of audit staff has to be assigned to conduct RBA, part to conduct compliance audit) and the implementation of the transaction principles into the audit process is very time consuming. The possible solution of this problem is the introduction of so called automatic or continuous auditing. This solution will be further discussed later in the text.

Besides the approaches mentioned above, there are several others, less important or strongly sector-specific. Wynne (2004) mentions the example of a pre-payment audit consisting of control of payment documents just before the related transaction is carried-out (in essence, this is a form of ex-ante compliance auditing). Another approach, mentioned e.g. by Lonsdale (2000) is a value-for-money auditing, dealing mainly with assessment of the effectiveness and costs at which the institution (usually a government - but not exclusively) manages the resources entrusted. Rattliff et al. (1996) mentions a performance audit, focused on the efficiency and effectiveness of the company (although this area falls within the scope of controlling, rather than audit), quality audit and audit of financial controls (including control of accounting and financial indicators).

## 3. Basic principles of risk management via risk based auditing

Application of the principles of the RBA is reflected both in the planning and running phase of audits.

### 3.1 Planning in the process of RBA

The basic requirement for the RBA is the existence of the Audit Universe (AU). This consists of a list of all auditable actions and activities assigned to the audited entity. This list is then the primer basis for the subsequent risk assessment and preparation of the risk-based audit plan.

In literature (e.g. Griffiths 2006), the requirement for additional register can be found - the register of risks identified by the management of business departments. This risks identified by business should be afterwards assigned to particular actions and activities registered in the AU. In practice, however, the requirement for a risk register is stated differently - the risk management system is divided into three parts (or sometimes called three lines of defense) - the first part is the management of individual business units which is required to identify the risks associated with the processes in its responsibility and also manage some basic risk-related tasks (e.g. establishing the job position of a local risk managers). The second part, consisting of specialized risk management departments and other individual risk-management functions is working with risks identified by management (of course not only by them). The third part is mainly control focused and it is provided by the internal audit dept. One of the most important conditions of the successful operating of the audit work is the auditors´ independence. In order not to jeopardize it, it is necessary for the audit to run its own risk map. There are many reasons for such an individual approach - the management of business units may not be able to identify all the risks associated to the activities within its competence (one can consider some "professional blindness" or the management may not always be motivated to reveal all the risks, as such a reveal can bring more attention of auditors). The risks of activities recorded in the AU should thus be determined directly by auditors and risk management registers should be considered only as the one of the sources used while determining the risks.

**Scheme 1: RBA process**
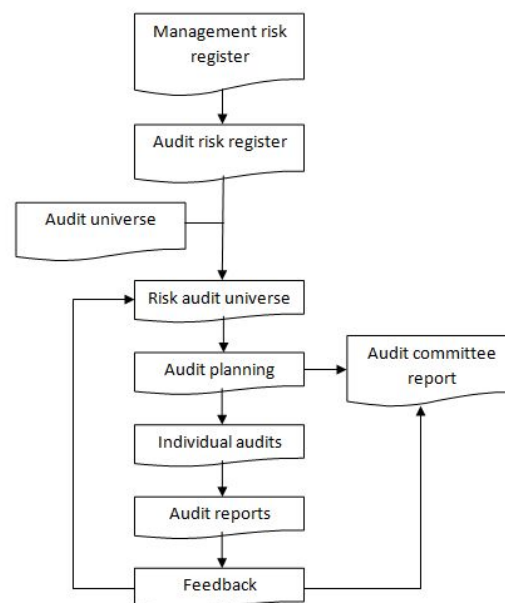


**Source: own arrangements**

After assigning the particular risks, the individual activities are grouped into so-called auditable units (e.g. retail loans, asset-liability management, subsidiaries, etc.). These units are then evaluated in terms of risks and materiality.

At first, the inherent risks are analyzed (IR - the risk based on the very nature of the activity, measured before application of controls). Also the controls risk is analyzed (the risk rising from inefficiency of controls applied). The inherent risk analysis involves classical groups of risks e.g. market risk, credit risk, operational risk, reputational risks, legal risk etc. The length of the period since the last audit performed can be also involved as one of the parameters. These risks are evaluated based on auditor´s professional judgment for each activity involved in the given auditable unit. Usually the scale of 0-5 is used, but direct verbal classification is also possible.

**Table 1: Assessment of inherent risk of auditable unit**

| Auditable unit Retail Credits | Credit risk | Market risk | Operational risk | Reputational risk | Total |
|---|---|---|---|---|---|
| Client´s identification | 5 | 1 | 3 | 1 | 10 |
| Client´s registration | 3 | 1 | 5 | 1 | 10 |
| Evaluation of the request by the system | 2 | 1 | 1 | 1 | 5 |
| Evaluation by the underwriter | 4 | 1 | 3 | 3 | 11 |
| Overall IR score for the whole unit | 9 | | | | |

**Source: own arrangements**

The total score for the inherent risk of auditable unit is then calculated as the average of risk values of all the activities included in the unit. This numerical value is then (based on the risk scale) transferred into verbal classification (low, medium, high).

Besides this approach, requiring a relatively detailed breakdown of auditable units, it is also possible to use the less detailed approach consisting of a direct evaluation of individual risk categories of the auditable unit (i.e. without the necessary breakdown). The total value of IR for auditable unit is then simply given as a sum of individual risks values.

The control risk is analyzed in the similar way. The analysis consists of the evaluation of the quality of the internal control, management approach to risks etc. The scores of the control and inherent risk are then recorded into frequency matrix, which determines the required frequency of audits in aforementioned auditable unit. (1 – yearly; 4 – each four years).

**Table 2: Frequency Matrix**

| | | Control risk | | |
|---|---|---|---|---|
| | | Low | medium | high |
| Inherent risk | low | 4 | 4 | 3 |
| | medium | 3 | 3 | 2 |
| | high | 2 | 1 | 1 |

**Source: own arrangements**

The IRB methodology in general requires the main focus of auditors to be set on the most risky areas of the company. This, however, does not mean that the riskless, less-risky or less significant parts of the company should be completely omitted. The minimum frequency at which control of the less significant departments should be evaluated depends entirely on the decision of the company. The optimal frequency is considered to be about 4-5 years.

Besides the above mentioned approach using the frequency matrix, there are many other ways how to approach the risk-based planning. One of them is a simple comparison of overall risk scores of particular units. In this case, the numerical values of the inherent and control risk are not transferred to the verbal evaluation, but are added together. Total risk score is then recorded to Risk Audit Universe and the resources are allocated according to the risk score order. The advantage of this approach is, in addition to its simplicity, the fact that it allows direct comparison of the annual values of the total risk. The growth of this value should then have consequences in the shortening of the audit period.

During the analysis of inherent risk also one of its most important parameters is assessed - the materiality (significance) of impact of its realization. In case of verbal evaluation, the effect of materiality may be added by simply decreasing or increasing of the evaluation level (e.g. by lowering the riskiness from medium to low).or the IR score (before the transformation to verbal evaluation) can be multiplied by the materiality weights. In case of pure numerical evaluation, the materiality coefficient is simply added to the overall risk score

**3.2 Principles of the RBA during the audits´ run**

The principles applied during the audit planning phase are applied also in the actual course of individual audits. The difference here lies in the fact that while in the planning process the risks are assessed in relation to the auditable units and processes, during the run of particular audits, the evaluation is done on activities level.

Again, there is the inherent and the control risk assessment involved. Risks taken from the Risk Audit Universe (or added to the process directly by the auditor) are recorded in the Risk Matrix and evaluated in terms of likelihood and size of potential impact.

**Table 3: Evaluation of inherent risk**



**Source: Griffiths (2006); customized**

The table of the inherent risk assessment assumes the numerical assessment on scale of 1-5 and risk appetite set on level 4 (i.e., if the overall inherent risk score will be less or equal to 4, the risk will be, in order of efficiency, considered as irrelevant for the additional audit testing). The rest of the risks will be involved in standard audit testing procedures. In ideal case, the implemented control will be sufficiently effective to lower the residual risk score below the 4. If it isn´t, the written recommendation to the management of related business unit is formulated in the final audit report. Based on the residual risk score, the priorities are assigned to the particular recommendations. After the final report publication, the follow-up phase of the audit is started (the evaluation of recommendations fulfillment).

**4. Continuous auditing as the direction of future development of internal audit**

The RBA is now clearly most widely used methodology of internal audit. But the development in IT area has its effects also in the audit domain. This trend is mostly evident in the development of so called automatic or more often continuous auditing (CA). The theoretical origins of this tool can be dated back to the mid-nineties. In practice, the first attempts to implement CA appeared at the turn of the century.

Continuous auditing is defined by Kogan et al. (1999) as the type of auditing that produces results at the same time or within a short interval after the event occurs. The Institute of Internal Auditors defines continuous auditing as an automatic method

used for valuation of risks and controls at regular (frequent) basis.

In essence, it is not a separate audit methodology, but one of the practical applications of the transactional audit methodology. As mentioned above, the transactional or compliance based audit is a bit outdated methodology. The main goal of current auditing is not a detailed analysis of individual transactions, but rather risk-based view on the audited area. Despite all this, there are still areas, primarily related e.g. to the regulator reporting, where the use of a transactional approach remains important (risk here derives mainly from penalties for fail for inaccurate reporting to regulatory authorities). It is also possible to implement some risk-based principles into the process and also to use its outcomes as a basis for further RBA planning.

The process of the continuous auditing is largely a technical matter. Significantly lower interest of both academics and practitioners is focused on its implementation into the audit, or risk-management frameworks in general. Even though it is mainly a transactional audit, it is possible to incorporate in it some of the RBA components (mainly in relation to dealing with its outcomes). The most of continuous audit procedures are based on a rule-based method. Less frequent (mentioned for example by Lee (2007)) is a case-based method, introducing the elements of the precedent into the process of the continuous auditing by comparing individual transactions with pre-set precedent cases and subsequent application of precedent remedial actions (in case of LEE mainly repressive).

The rule based method is based on the setting of the clear rules derived from the internal methodology or regulatory rules, and its registration in special database (rule database). The ongoing transactions are then assessed by the specially designed software in sense of compliancy with rules registered in the rule database. In case that the transaction violates some of the rules, the report is generated and the auditor is immediately informed about the transaction.

As already mentioned, it is theoretically possible to include some limited elements of the RBA into this process – this could be done by setting a limit (in sense of amount or materiality of rule breached) for erroneous transactions, corresponding to the risk appetite of the company or the audit department. In case that the erroneous transaction amount is below this threshold, only the business management is informed. Otherwise (serious violations or the transaction above the limit) the auditor is informed. In both cases these incidents should be recorded in detail - both for possible use for case-based identification, or as one of the important risk estimation inputs for the subsequent risk-based audit planning

**Scheme 2: The process of rule-based continuous audit with the risk-based elements involved**
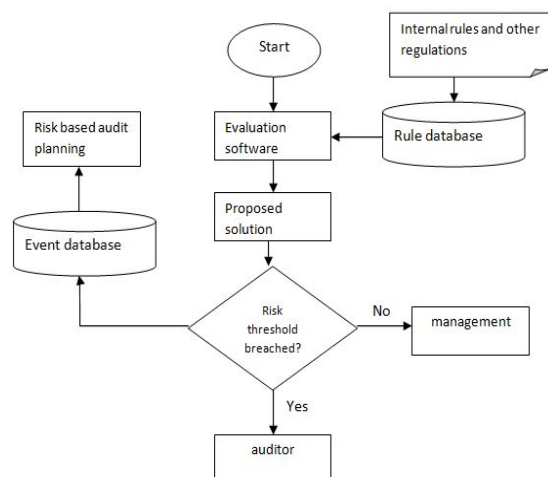


**Source: Own arrangements**

The procedure above is one of the possible forms of the assurance based audit, mentioned e.g. by Griffiths (2005) as one of the most innovative approaches to provide a comprehensive audit control. Along with continuous monitoring from the business side, this combination represents a very effective internal control framework. Despite above mentioned the continuous auditing is still very rarely used approach in practice. Barrier of larger expansion of CA can be found in insufficient information availability – there are a number of theoretical papers on the continuous auditing and there are also a number of practical manuals, but most of these are strongly IT orientated. But the main users of such system do not recruit from academics or IT professionals – they are just standard auditors and from their point of view there is still a large information gap.

There are also some limitations in practical point of view – especially in data availability area. The continuous auditing requires access to transactional systems´ data flow and such a connection is very difficult to establish. The costs of such implementation are also one of the important factors preventing the CA growth.

**5. Conclusion**

Internal audit in the modern sense is a relatively new but rapidly developing profession. This is caused by the large expectations from both regulators and management of audited companies.

The methodological approaches to audit work are changing during the time, but the main trend is set in direction of the risk related and process based matters rather than on rules compliancy. This is also reflected in the currently most applied methodology – risk based auditing. In this essay the RBA methodology was analyzed and some future perspectives were outlined – mainly in relation to the implementation of continuous auditing into Risk Based structures. The continuous auditing, even though representative of a bit outdated compliance/transaction based auditing, could bring significant improvements into the RBA approach. Nevertheless, there are still barriers in the way to its wider implementation – mainly related to data availability. This, however could change while e.g. old, incompatible transactional systems in banks are gradually replaced by the new, more suitable ones. The monitoring-net consisting of the management reporting, continuous auditing and RBA as presented here, represents one of the most suitable the future of auditing and risk management.

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**Primary Paper Section:** A

**Secondary Paper Section:** AH

# SELECTED ASPECTS OF PUBLIC HEALTH PROTECTION RELATED TO RENEWABLE ENERGY USE

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Abstract: Public health protection is a complex and multidisciplinary issue. It is related, *inter alia*, to the process of environmental impact assessment. However, there are gaps in relevant legal regulation from the viewpoint of health risk assessment. Although the technologies using renewable energy are considered having benign environmental consequences, some projects can have negative impacts on human health. These effects must be taken into consideration by administrative authorities within relevant procedures. Their decision-making may be influenced by public participation when executing fundamental human rights.

Keywords: Public health, impact assessment, precautionary principle, renewable energy, administrative procedures.

## 1 Introduction

Currently, public health protection associated with the use of energy from renewable sources is the issue of pressing importance. However, awareness of this subject-matter cannot be considered sufficient although it significantly affects decisions of public authorities, in addition to attitudes of the public in decision-making procedures.

In order to answer the question of whether or not public health protection is adequately taken into account by public authorities, especially in processes connected with granting investors/operators permission to locate and/or operate the equipment for the production of energy from renewable sources, it is necessary to analyse relevant legal regulations, impacts of power plants generating energy from renewable sources, a position of concerned authorities, relevant administrative procedures as well as their consequences in practice.

## 2 Public health protection

Public health protection against environmental risk factors is examined from two different perspectives in the Czech Republic. The first viewpoint is represented by the public health protection including medical care, and the second one is the perspective of environment protection. However, these two approaches are not sufficiently interconnected. The legal regulation for public health protection by virtue of Public Health Protection Act No 258/2000 Coll. includes only some aspects of environmental hygiene namely in the connection with the health risk assessment. The legal regulation relating primarily to the environment protection regulates the procedure of the environmental impact assessment. These procedures should serve *de lege lata* for complying with the precautionary principle. These issues emphasize especially the part of the procedure of the environmental impact assessment aimed at the public health impact assessment. Current legal regulation of health impact assessment in the procedure of the environmental impact assessment fails to provide the guaranties for overall and objective environmental health risks in compliance with the precautionary principle. The public health impact assessment is not clearly formulated as the part of the procedure of environmental impact assessment. That is reflected even in the Strategic impact assessment. In respect of public health, Strategic impact assessment should be instituted *de lege lata* as early as possible in the screening phase. However, by virtue of the current legal regulation, the procedure has not been clearly determined when the screening phase fails to find the strategic impact assessment on the environment, but the impacts on the public health may be expected at the same time.

Another imperfection of the current legal regulation (consisting of the ignorance of the precautionary principle in the sphere of public health protection against the environmental risk factors) can be seen in health risk assessment. The concept of the health risk assessment can be compared to the concept of the reasonably attainable extent that has been defined in special provisions of the Public Health Protection Act (therefore taking precedence over general provisions). The consistent essence of both terms consists in preventive assessment of environmental burden affecting the health of an individual. Reasonably attainable extent can be expressed in general as the proportion between the costs for taking measures in respect of the health protection of an individual on one hand, and their contribution to decreasing environmental burden harmful to the health of an individual on the other hand. The proportion between the costs and the effectiveness of possible measures can also be determined even with respect to the number of natural persons exposed to noise exceeding the limits, e.g. in the area of protection against noise. In this context, the implicit consequence of considering the number of the persons exposed is not only immoral but (moreover) it is incompatible with the constitutional principle of equality and the constitutional establishment of the right to health protection by virtue of Article 31 of the Charter of Fundamental Rights and Freedoms (Constitutional Act No 2/1993 Coll.).

Thus, it may be observed that within the intention of the legal regulation directly relating to the public health protection, the requirements for the health protection of an individual may be limited or limited by the effect of economic expenses for the elimination of harmful consequences. The protection of public health is therefore limited not only by economic assets or advantages but (furthermore) it is limited by determining the limits for exposition to risk factors only on the basis of directly shown harmful health impacts. Legal regulations can take into consideration the risk at the threshold of science i.e. the risk that has not been yet proven to result in harmful health consequences.

The same attitude has also been taken by the European Court of Justice in its case law. Some formulations of the current legal regulation give rise to the question of whether or not they can be understood, by means of logical interpretation, to be subsumed under the term of the health risk or whether even the danger to health should not be taken into consideration when interpreting and applying them. In the sphere of the public health protection against the environmental risk factors, the precautionary principle has not been consistently and adequately implemented in Czech legal legislation.

## 3 Promotion of renewable energy use

The problem of global warming, which should be solved *inter alia* through the use of renewable energy, has led to the adoption of legal documents at the international, the European Union and national levels.

The international level is represented by the Kyoto Protocol to the United Nations Framework Convention on Climate Change (1992, New York). The preamble of the Convention expresses the interest in ensuring the responses to climate change in an integrated manner coordinated with social and economic development. Under Article 2 of Kyoto Protocol, adopted in 1997, each Party shall implement and/or further elaborate policies and measures such as research on, promotion of, and the development and the increased use of new and renewable forms of energy, etc.

Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC is the most important source of European Union law on the issue in

question. This Directive sets, *inter alia*, mandatory national targets for the overall share of energy from renewable sources in the gross final consumption of energy and for the share of energy from renewable sources in transport (without binding mechanisms). When providing a binding national target, the need for consistency in energy and environmental policy should be taken into account. This Directive was adopted in order to implement the aforementioned international commitments in addition to reducing the dependence on energy imports, to create new jobs through decentralized energy production, to support rural development, long-term stability of the business environment, research and development, and so forth. The Directive should be implemented by several Czech laws such as Renewable Energy Act No 180/2005 Coll., Promoted Energy Sources Act No 165/2012 Coll., Energy Act No 458/2000 Coll. and so forth.

However, it is essential to realize that Article 7 of the Constitution of the Czech Republic (the Constitutional Act No 1/1993 Coll.) obliges the State to ensure prudent use of natural resources and protection of natural wealth. This provision gives a basis for interpretation of the relevant regulations on the promotion of energy from renewable sources; the duty of the state to protect the environment and to respect this priority in its own affairs as well as a legitimate reason for the governmental regulation of certain activities carried out by private entities can be deduced.[1] This article is associated with the Environmental Act No 17/1992 Coll., as amended, which should not be ignored when interpreting relevant legislation. Under its Section 17, every individual is obliged to prevent environmental pollution or to minimize the unfavourable environmental impact, to carry out activities such as building structures only after assessing their impact on the environment, and to provide for the assessment of their potential impact on the environment in cases stipulated by special regulations.

**4 Impacts of renewable energy use**

Generally speaking, the technologies using renewable energy are considered having benign environmental consequences because they do not release carbon dioxide or nitrous oxide into the atmosphere, produce no water pollution and involve no toxic or hazardous waste, and pose minimal threats to public safety and to the environment. However, some projects do face environmental and other hurdles.[2]

The use of renewable resources is considered the solution to the situation caused by fossil fuels including emissions of pollutants and the greenhouse gases that are causing climate change and risks to the security of their energy supplies.[3] According to a number of representative organizations of producers of energy from renewable sources, a major barrier to the further development of the use of energy from renewable sources in the European Union is the administrative and planning procedures that potential generators must meet.[4]

These procedures deal with impact of the use of energy from renewable sources on the environment and human health. It is essential to realize that ´*all forms of energy have their price ... no form of energy provides us ... energy use free from negative environmental, public health, and other societal costs*´.[5] Therefore, it is necessary to assess if positives of the use of renewable energy outweigh negatives and if negatives are more manageable than those of fossil or nuclear fuels.[6]

**4.1 Impacts of power plants generating energy from renewable sources on human health**

According to the *Committee on Environmental Impacts of Wind Energy Projects,*[7] wind-energy projects can have positive as well as negative impacts on human wealth; the positive impacts accrue through improvements in air quality and the negative impacts are experienced mainly by people living near wind turbines whose are affected by noise and shadow flicker (i.e. moving shadows on the ground resulting in alternating changes in light intensity). Wind turbines generate noise during operation as machine involving moving parts. There are several types of noise, its levels and sources. The perception of noise depends in part on the individual, his or her subjective tolerance; subjective impressions of the noise from wind turbines are not totally idiosyncratic. Noise impacts can result from project maintenance such as noise associated with traffic into and out of the facility. Older turbines emit some infrasound but it is believed that it does not pose a health hazard. However, there have been ongoing debates over deterioration in sleep quality to people living nearby; sensitivity to low-frequency vibration resulting from wind-turbine noise is highly variable among humans. As noise-emission measurements are subject to problems, methods for assessing noise levels produced by wind turbines located in various terrains need further development. Therefore, implementation of various measures to reduce noise in addition to acceptability standards for noise is important. The phenomenon of shadow flicker is different from a strobe-like phenomenon (caused by intermittent chopping of the sunlight behind the rotating blades); it can be a nuisance to nearby humans, and its effects need to be considered during the design of a wind-energy project.

In the Czech Republic, it is assumed that aforementioned and other possible impacts are primarily of a local nature. In comparison with conventional sources of energy, there are not important. As far as wind turbines are concerned, their appropriate location can reduce or eliminate negative impacts. Effects of wind turbines vary depending on their location, number, technical design, and construction method. From the investor's perspective, the decisive factor for the location of wind turbines is the power of wind in a certain area. In addition, it is necessary to observe natural minimum distances from the nearest human settlements and legally established distance from protective zones, roads, power lines, air corridors and buildings, etc.[8]

Biogas plants can serve as a different example of questionable power plants generating energy from renewable sources. Biogas technology is based on the principle of anaerobic digestion. The most common form is the use of combustion in cogeneration plants for the production of electricity and heat. Biogas is the gas consisting of methane, carbon dioxide, nitrogen, hydrogen sulphide, ammonia, water, ethane, and other lower hydrocarbons. The public generally considers biogas plants as a source of odour nuisance. However, there were some cases caused by poor-quality, low-cost technology or technological indiscipline during operation, or their combination. Some operators failed to fulfil their legal obligations and did not hesitate to do business at the expense of the health of their fellow citizens. Furthermore, administrative authorities have not been able to stop such behaviour. Nevertheless, the vast majority of biogas plants operate without any problem or they have even achieved a reduction of odour in the area (e.g. if it concerned processed manure). Hence, modern technology and adequately trained staff are essential. Properly designed biogas plants can be placed into built-up area, especially in brownfields (within the

[1] Šimíček, V. In Bahýľová, L., Filip, J., Molek, P. et al.: *Ústava České republiky: komentář*. Praha: Linde, 2010. 1533 p. ISBN 9788072018147. P. 132-133.
[2] Tomain, J. P., Cudahy R. D.: *Energy law: in a nutshell*. St. Paul: Thomson, 2004. 392 p. ISBN 0314150587. P. 354-361.
[3] Jones, Ch. W. (ed.): *EU energy law. III. EU environmental law: energy efficiency and renewable energy sources*. Leuven: Claeys & Casteels, 2006. 706 p. ISBN 9077644032. P. 1.
[4] Ibidem, p. 52.
[5] Pring, G. R. et al.: The Impact of Energy on Health, Environment, and Sustainable Development: The TANSTAAFL Problem. In Zillman, D. et al. (eds): *Beyond the Carbon Economy: Energy Law in Transition*. Oxford: Oxford University Press, 2008, 562 p. ISBN 9780199532698. P. 13-15.
[6] Ibidem, p. 26.

[7] Committee on Environmental Impacts of Wind Energy Projects, National Research Council: *Environmental Impacts of Wind-Energy Projects*. Washington, D.C.: The National Academies Press, 2007. 394 p. ISBN 0309108357. Available at: http://www.nap.edu/catalog.php?record_id=11935. P. 157-162.
[8] *Povolovací proces obnovitelných zdrojů energie* [online]. Ministerstvo životního prostředí, 2010. 103 p. [cit. 31.10.2012]. Available at: http://www.sysnet.cz/C125774C00336141/cz/povolovani_a_predpisy/$FILE/Povolova ci_proces_OZE_2010_01_13.pdf. P. 42.

necessary distance from residential areas). Administrative authorities should carefully check the parts of project documentation which are crucial for protection against odour. Their decisions should be convincingly justified including specific conditions in order to ensure odourless operation of a biogas plant.[9]

## 5 Relevant administrative procedures

Energy activities have their impact upon the individual, raising human rights implications, and upon the environment.[10] Environmental protection, health and safety are primarily regulated on the basis of separate laws.

In the Czech Republic, the issue in question is regulated by several laws (within the procedures of land-use planning, spatial process, building permission, licensing of operation, final inspection, etc.), especially: Building Act No. 183/2006 Coll., as amended, Environmental Impact Assessment Act No. 100/2001 Coll., as amended, Public Health Act No. 258/2000 Coll., as amended, and Code of Administrative Procedure No. 500/2004 Coll., as amended.

### 5.1 Documentation, permits, and binding opinions of concerned authorities

With regard to impacts of power plants generating energy from renewable sources on public health, concerned authorities may apply their requirements for the processing of materials in order to assess impacts of projects of power plants on the environment and public health within relevant procedures such as the process of environmental impact assessment and others. Typical documentation includes noise study and study of health risks (analysis of the effects on public health).

There are many permits, binding opinions, and observations that are required for different types of power plants in addition to a number of recommendations and requirements for the operating rules. Their strict compliance should prevent cases of a public nuisance.

For example, under Section 14, Sub-section 1 of Waste Management Act No. 185/2001 Coll., as amended, a heating plant or a biomass power plant that burns waste may be operated only with the consent to the operation of waste treatment facilities. The consent has the form of an administrative decision; a set of operational rules shall be an integral part of the consent as its annex. When approving the set of operational rules, a locally competent authority of public health protection is the concerned authority. The required consent cannot be granted without an affirmative statement of this authority to the part of the set of operational rules regarding safety, protection of the environment and human health.

## 6 NIMBY syndrome in decision-making

According to McHarg and Rønne,[11] whereas environmental benefits of renewable generation are national and even global in their scope, environmental harms are typically borne by local communities. The long-term success of the generation depends upon the public´s consent and their willingness to bear the additional costs involved. ´Many of their objections are selfish or misinformed".[12]

Attitudes of the public to the power generation from renewable energy sources plants are affected by many different factors associated with physical and technological aspects, contextually-environmental aspects, energy policy, social relations, representation of renewable energy sources, socio-economic aspects, local aspects such as so-called *NIMBY syndrome*, or knowledge of the subject-matter in question.[13]

The aforementioned acronym (*Not In My Backyard*) expresses (in its pure form) unwillingness to tolerate in a certain territory some negative impacts of the activity that is beneficial to a whole. Therefore, it is a spatial isolation of advantages and disadvantages. This approach has other variations; it relates to a wider range of projects pressing ´higher interest´. It is controversial whether this is a manifestation of provincial, short-sighted and selfish interests.[14]

According to Improta and Pinheiro,[15] it is still important to widen the options for renewable energies having a softer impact on the environment than other forms of energy but this development must be followed by the provision of better information and greater participation of the community in addition to narrowing the gap between advanced energy technologies and the general living conditions of the people who coexist alongside power plants.

## 7 Conclusions

When considering the answer to the question of whether or not public health protection is sufficiently taken into account in processes of issuing a permit to the location and operation of some equipment for the production of energy from renewable sources, it is essential to admit that the current state of relevant legal regulation cannot be seen optimal due to several imperfections regarding health risk assessment in addition to inadequate application of the precautionary principle. As far as public health protection related to the renewable energy use in practice is concerned, there were some examples of improper functioning of administrative authorities in cases of investor failure to fulfil their legal obligations. However, both groups of entities must be controlled by the public in relevant administrative procedures through realizing constitutionally guaranteed fundamental rights such as the right to participate in administration of public matters and the right to access to information on the environment.

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8. Committee on Environmental Impacts of Wind Energy Projects, National Research Council: *Environmental*

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[9] *Povolovací proces obnovitelných zdrojů energie.* Op. cit., p. 55-57.
[10] Roggenkamp, M. M., Redgwell, C. Guayo, I. (eds): *Energy Law in Europe. National, EU and International Regulation.* 2nd ed. New York: Oxford University Press, 2007. 1488 p. ISBN 9780199217719-9. P. 14.
[11] McHarg, A., Røne, A.: Reducing Carbon-Based Electricity Generation: Is the Answer Blowing in the Wind? In Zillman op. cit. P. 292.
[12] Ibidem, p. 315.

[13] Cetkovský, S., Frantál, B., Štekl, J. et al.: *Větrná energie v České republice: hodnocení prostorových vztahů, environmentálních aspektů a socioekonomických souvislostí.* Brno: Ústav geoniky Akademie věd ČR, 2010. 208 p. ISBN 9788086407845. P. 198.
[14] Ibidem, p. 158.
[15] Devine-Wright, P. (ed.): *Renewable energy and the public: from NIMBY to participation.* London: Earthscan, 2011. 336 p. ISBN 9781844078639. P. 230.

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# INSTITUTIONAL INVESTORS IN THE LARGEST POLISH CAPITAL COMPANIES – THEORY AND PRACTICE

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Abstract: The Polish and foreign literature emphasize the role of institutional investors as entities affecting corporate supervision. The objective of the paper is to present and systemize issues related with the definition and classification of institutional investors. The empirical part includes a presentation of the ownership structure of the 20 largest Polish public companies listed on the Warsaw Stock Exchange on the WIG 20 Index with the stress on institutional investors.

Keywords: institutional investors, corporate governance, capital market

## 1 Introduction

Capital market is a significant element of the free-market economy and, consequently, the studies on its characteristic are of crucial importance.

Nowadays, 430 organizations are publicly traded companies listed on the Warsaw Stock Exchange.[1] Investors holding a substantial block of shares play a crucial role in their operation. It seems that they are in position to affect managers, yet it is difficult to explicitly specify what share size in the company's ownership makes them "think as an owner." On the other hand, the ownership structure translates into the company's "security." It is possible to assume that 20-30 per cent share ownership provides sufficient control to prevent a hostile takeover.[2] As regards engagement in the corporate governance process, investors adopt active or passive attitudes depending on the number of shares they hold. Importantly, the ownership structure is among major determinants of the rules of corporate governance. Two types of ownership and control structures are distinguished: outsider and insider. The outsider system, which predominates in the United States and Great Britain, is characterized by dispersed ownership. Outside mechanisms, i.e. the product market, the labour market for managers, and the capital market, are used to control the company operations. On the other hand, the insider system predominated in Continental Europe, including Poland and Germany. Inside mechanisms play a key role in this system (including company board's operations). The insider system is characterized by the concentrated ownership, which means that a number of shareholders hold substantial blocks of shares.

Holding a controlling interest encourages shareholders to adopt active attitudes in the corporate governance.[3] Thus, the question about the type of an investor holding a controlling interest, i.e. whether it is an institutional, individual, industrial or other investor, becomes crucial.

A position of institutional investor as an entity having effect on the corporate governance is emphasized in the Polish as well as foreign professional literature.[4] Noteworthy, a number of definitions and classifications of institutional investors are offered. The definitions of an institutional investor are similar but classifications different, which results from the differences between capital markets found in the world.

The objective of the paper is to systemize institutional investor classification-related issues based on literature studies. We have applied theoretical considerations to economic practice. The empirical part of the paper includes the ownership structure of 20 largest companies listed on the WIG20 Index on the Warsaw Stock Exchange. The study focuses on a number of voting shares held by institutional investors in the WIG 20-listed companies. It seems that a number of voting shares determines institutional investors' power to affect decisions made by the board. Yet, a question arises as to whether they hold a sufficient number of votes to affect company operations.

## 2 The essence and different types of institutional investors

As it is stressed in the literature, an investor seeking a majority interest may not sell his shares without risking substantial losses following the price drop of these shares.[5] Therefore, majority investors should think through their investment policies.

Numerous authors highlight the power of institutional investors as a specific group of stakeholders able to play a role of active shareholders.[6] Their activity may be a perfect means to resolve agency conflicts following the separation of ownership and management.[7] Institutional investors holding a majority interest are in position to influence the decisions made by managers.[8] Thus, it is necessary to consider who institutional investors are and what entities may be classified into this group of shareholders.

A number of different definitions of an institutional investor are offered in the literature.

J. C. Dreyer defines institutional shareholders as the financial institutions which accumulate funds which are the property of individual investors. Moreover, he emphasizes that such institutions act as their representatives.[9]

According to D. Dziawgo, an institutional investor is an entity which invests its own funds or exercises discretion over the funds of a client.[10]

On the other hand, D. Niedziółka defines an institutional investor as an organization which investing substantial funds entrusted in the form of deposits or contributions.[11]

According to the Organization for Economic Cooperation and Development (OECD), an institutional investor is a major collector of savings and supplier of funds to financial markets.[12]

It seems that these definitions provide a number of common features of an institutional investor. All the quoted authors agree that institutional investors (defined as financial institutions, entities, organizations, collectors of savings) multiply funds entrusted by stakeholders (defined as clients, individual investors, and donators).

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[1] http://www.gpw.pl/lista_spolek, state as of 14.10.2012.
[2] T. R. Eisenmann, *The Effects of CEO Equity Ownership and Firm Diversification on Risk Taking,* "Strategic Management Journal", 2002, No 23, p. 527, as cited in: P. Urbanek, *Struktura własności i kontroli w polskich spółkach publicznych w warunkach kryzysu gospodarczego,* [in:] *Nadzór korporacyjny a przedsiębiorstwo,* "Prace i Materiały Wydziału Zarządzania Uniwersytetu Gdańskiego", 2009, No 1, p. 386.
[3] P. Urbanek, *Nadzór korporacyjny wynagrodzenia menedżerów,* Wydawnictwo Uniwersytetu Łódzkiego, Łódź 2005, pp. 75–83.
[4] Por. M. Aluchna, *Mechanizmy corporate governance w spółkach giełdowych,* Warsaw School of Economics, Warsaw 2007, p. 82; Ch. A. Mallin, *Corporate governance,* Oxford University Press, New York 2007, pp. 80–83.

[5] K. Postrach, *Problemy nadzoru w spółkach z dominującym inwestorem,* [in:] S. Rudolf (ed.), *Efektywność nadzoru właścicielskiego w spółkach kapitałowych,* Wydawnictwo Uniwersytetu Łódzkiego, Łódź 2000, p. 140.
[6] I. Koładkiewicz, *Rola akcjonariuszy instytucjonalnych w sprawowaniu nadzoru,* [in:] S. Rudolf (ed.), *Strategiczne obszary nadzoru korporacyjnego zewnętrznego i wewnętrznego,* Wydawnictwo Uniwersytetu Łódzkiego, Łódź 2002, p. 219.
[7] A. Bielecki, *Rola inwestorów instytucjonalnych w monitorowaniu spółek,* [in:] S. Rudolf (ed.), *Ekonomiczne i społeczne problemy nadzoru korporacyjnego,* Wydawnictwo Uniwersytetu Łódzkiego, Łódź 2004, p. 281.
[8] J. S. Dreyer, *Aktywizm inwestorów instytucjonalnych w systemie rynkocentrycznym,* [in:] K. A. Lis, H. Sterniczuk (ed.), *Nadzór korporacyjny,* Oficyna Ekonomiczna, Cracow 2005, p. 229.
[9] Ibidem, p. 229.
[10] D. Dziawgo, *Relacje inwestorskie. Ewolucja – funkcjonowanie wyzwania,* Wydawnictwo Naukowe PWN, Warsaw 2011, p. 45.
[11] D. Niedziółka, *Relacje inwestorskie,* Wydawnictwo Naukowe PWN, Warsaw 2008, p. 45.
[12] *Institutional Investors. Statistical Yearbook 1992-2001,* OECD, Paris 2003, p. 3, www.sourceoecd.org.

We define institutional investors as the institutions which are entrusted with the funds of individual entities to effectively manage the funds. To reduce the risk of losing the funds, institutional investors actively monitor the activities of investee company management.

Seemingly, definitions of institutional investors should correspond with their classifications. Yet, it turns out that the classifications offered in the literature are different.

Table 1 provides selected classifications of individual investors based on the literature studies.

Table 1. Classification of institutional investors

| Institutional investors | Authors of classifications of institutional investors | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | J. S. Dreyer | D. Dziawgo | F. J. Fabozzi | J. Jeżak | D. Niedziółka | J. Solomon | OECD | P. Urbanek | K. Zabielski |
| Insurance Companies | X | X | X | X | X | X | X | X | X |
| Pension Funds | X | X | X | X | X | X | X | X | X |
| Investment Funds | X | X | X | X | X | | X | X | X |
| Banks | X[1] | X | | X | X | | | X | X[9] |
| Brokerage Houses | | X | | | | | | | X |
| Asset management | | X | | | | | | | |
| Hedge Funds | | X | X | | | | | | |
| State Treasury | | X | X[3] | | | | | | X |
| Sovereign wealth funds | | X | | | | | | | |
| Self-government Units | | X | | | | | | | |
| Private equity / venture capital | | X | | X | | | | | X |
| Deposit Institutions | | | X[4] | | | | | | |
| Endowments and foundations | | | X | | | | X | | |
| Other | | X[2] | | X[5] | | X[6] | X[7] | X[8] | X[10] |

X[1] - Commercial and investment banks
X[2] – Economic entities with available funds
X[3] - State Treasury, territorial self-governments and government agencies
X[4] - Deposit institutions (commercial banks, savings and loan associations and credit unions)
X[5] - Capital groups
X[6] - Investment trusts and Unit trusts
X[7] - Non-pension fund money managed by banks and private investment partnership
X[8] - Funds managed by banks
X[9] - Commercial banks (including investment banks)
X[10] - Enterprises

Based on: J. S. Dreyer, *Aktywizm inwestorów instytucjonalnych w systemie rynkocentrycznym*, [in:] K. A. Lis, H. Sterniczuk (ed.), *Nadzór korporacyjny*, Oficyna Ekonomiczna, Cracow 2005, p. 229; D. Dziawgo, *Relacje inwestorskie. Ewolucja – funkcjonowanie wyzwania*, Wydawnictwo Naukowe PWN, Warsaw 2011, p. 45; F. J. Fabozzi, *Institutional Investment Management: Equity and Bond Portfolio Strategies and Applications*, John Wiley & Sons, Inc, New Jersey 2009, p. 2; J. Jeżak, *Ład korporacyjny. Doświadczenia światowe oraz kierunki rozwoju*, Wydawnictwo C.H. Beck, Warsaw 2010, p. 83; D. Niedziółka, *Relacje inwestorskie*, Wydawnictwo Naukowe PWN, Warsaw 2008, p. 45; J. Solomon, *Corporate Governance and Accountability*, John Wiley & Sons, Ltd, Chichester 2007, p. 109; *Institutional Investors. Statistical Yearbook 1992-2001*, OECD, Paris 2003, p. 304; P. Urbanek, *Struktura własności i kontroli w polskich spółkach publicznych w warunkach kryzysu gospodarczego*, [in:] *Nadzór korporacyjny a przedsiębiorstwo*, "Prace i Materiały Wydziału Zarządzania Uniwersytetu Gdańskiego", 2009, No 1, p. 388; K. Zabielski, *Finanse międzynarodowe*, Wydawnictwo Naukowe PWN, Warsaw 2002, p. 208.

The classification reveals that authors offer different definitions of an institutional investor including an investment fund, pension fund, insurance company, bank, or the State Treasury, self-government unit, brokerage house, sovereign wealth fund, asset management, hedge fund as well as other entities. However, each typology includes insurance companies, pension funds, investment funds, and banks. Classification diversification of these organizations results primarily from the fact that different economic models are observed in the world and, consequently, capital markets are more or less developed, depending on the country. The divisions offered by different authors and given in Table 1 correspond with different economic models. Moreover, new organizations (e.g. asset management) result in the extension of classification of institutional investors.

On the other hand, differences in classification of institutional investors may also result from different perception of specific definitions: e.g. investment funds may be defined as the entities established to increase capital, so that everybody could benefit from their services. The savings of the clients who decides to invest in the fund are managed by professionals licensed to render investment consulting services. Following the investment strategy they attempt to maximize profit for their clients.[13] Hedge funds seem to be some kind of investment funds – they are distinctive type of investment funds, since they are to make money regardless of the prevailing market both in a boom and in a downturn.[14] Although their clients take a high investment risk (the investment strategy is frequently based on speculative operations), prospects of high rates of return are high. The above definition suggests that hedge funds may be recognized as investment funds. Yet, a number of scholars classify them as separate entities.

Classifying the State Treasury as an institutional investor raises doubts - it holds shares in privatized enterprises and companies listed on the Warsaw Stock Exchange but is not a typical entity which invests its own capital as well as the capital owned by individuals. Therefore, the State Treasury cannot be recognized as a typical institutional investor.

Undoubtedly, institutional investors are competent market participants as they know the industry and general development trends of companies they invest in. Substantial capital combined with the pressure from individuals and institutions that entrust them with their savings make them demand the rate of return adequate to the risk they take. To minimize the risk of the loss of value of the capital entrusted all the investment decisions require professional analysis of the data published by companies.[15]

Therefore, institutional investors who become financial intermediaries are required to adopt active attitude to maximize the rate of return from the capital they are entrusted. The factors on which investor's activity depends include the structure of the investment portfolio, share size or loyalty towards the company.[16] Diagram 1 presents different forms of activity of institutional investors.

[13] A. Banachowicz, *Fundusze inwestycyjne*, Internetowe Wydawnictwo Złote Myśli, 2007, p. 7.
[14] Ibidem,13-14 pp.
[15] A. Gajewska-Jedwabny, *Relacje inwestorskie i raportowanie wartości*, [in:] A. Szablewski, R. Tuzimek, *Wycena i zarządzanie wartością firmy*, Poltext, Warsaw 2008, p. 457.
[16] I. Koładkiewicz, *Rola akcjonariuszy...*, op. cit, pp. 210-211.

**Diagram 1.** Forms of activity of institutional investors
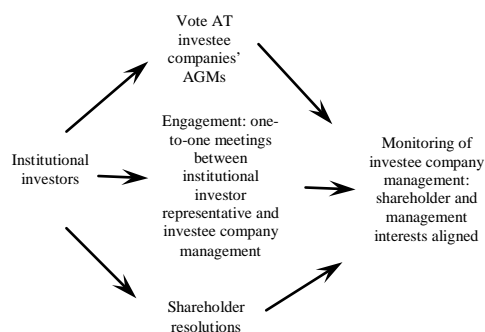


Source: J. Solomon, *Corporate Governance and Accountability*, John Wiley & Sons, Ltd, Chichester 2007, p. 119.

Institutional investors have capital as well as professional knowledge. A substantial block of shares enables them to monitor operations of boards and prevent them from pursuing particularistic goals.17 Moreover, they intend their goals to be aligned with the managers' goals. Consequently, they vote at general meetings of shareholders. Only shareholders holding a controlling interest are in power to affect resolutions adopted at general meetings. Noteworthy, institutional investors tend to be increasingly open to any meetings with board representatives to learn about the company's strategy, suggest possible solutions (through the dialogue) concerning investee's operations. These investors should act in such a manner that the decisions made by the board would be in line with their interests. One should also consider which objectives of institutional investors are considered by them to be most important. A number of authors claim that they focus on long-term objectives, which may improve a long-term performance of enterprises.[18] However, P. Urbanek pointed out that the time horizon of institutional investors is clearly becoming shorter. As they are under pressure to report current quarterly and annual figures concerning portfolio-asset management performance, they cannot afford investments over a long-time horizon, involving substantial current outlays.[19]

**3 Institutional investors in the ownership structure of the WIG20-listed companies**

It is frequently stressed that institutional investors are active corporate supervisory entities. When they hold a controlling interest they are in a position to affect the company operations.

The empirical part of the paper includes analysis of the ownership structure of the WIG20-listed companies on the Warsaw Stock Exchange. The WIG20 is the primary index on the Warsaw Stock Exchange as it covers shares of the 20 largest companies representing different industries (including IT, extractive, metal, food, fuel, insurance, banking, and telecommunication industries), whose shares are traded in the main market, and are characterized by the highest capitalization and stock exchange trading volume, as well as by highest liquidity in terms of sale and purchase of shares. As the WIG20-listed companies have a profound impact on trading volumes on the Warsaw Stock Exchange, it is worth studying their ownership structure.

To meet the needs of empirical studies, we have applied the classification of an institutional investor offered by P. Urbanek (insurance companies, pension funds, investment funds, banks and funds managed by banks).

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[17] M. Aluchna, *Mechanizmy...*, op. cit., pp. 82-83.
[18] Ibidem, p. 91.
[19] P. Urbanek, *Struktura własności i kontroli w polskich spółkach publicznych w warunkach kryzysu gospodarczego,* [in:] *Nadzór korporacyjny a przedsiębiorstwo,* "Prace i Materiały Wydziału Zarządzania Uniwersytetu Gdańskiego," 2009, No 1, p. 388.

Table 2 presents the ownership structure of WIG20-listed companies dated as of 12 October 2012, with the stress on institutional investors. The information given in the table was found at the web financial portals such as *money.pl* and *bankier.pl*, as well as the companies' websites.[20]

**Table 2.** Ownership structure of WIG20-listed companies, trading session of 12 October 2012

| Name of company | Industry | Largest shareholder | ∑ OFE | ∑ FI | ∑ institutional investors (OFE+FI) |
|---|---|---|---|---|---|
| ASSECOPOL | Informatics | 12.25%** | 21.92% | - | 21.92% |
| BOGDANKA | Primary | 14.74%** | 39.23% | - | 39.23% |
| BORYSZEW | Metal | 52.62% | - | - | 0.00% |
| BRE | Banks | 69.72% | 5.44% | - | 5.44% |
| GTC | Developers | 27.75% | 26.51% | - | 26.51% |
| HANDLOWY | Banks | 75.00% | - | - | 0.00% |
| JSW | Primary | 56.17% | - | - | 0.00% |
| KERNEL | Food | 38.23% | - | - | 0.00% |
| KGHM | Primary | 31.79% | - | - | 0.00% |
| LOTOS | Fuel | 53.19% | - | - | 0.00% |
| PEKAO | Banks | 59.23% | - | 5.03% | 5.03% |
| PGE | Power | 61.89% | - | - | 0.00% |
| PGNIG | Fuel | 72.41% | - | - | 0.00% |
| PKNORLEN | Fuel | 27.52% | 10.10% | - | 10.10% |
| PKOBP | Banks | 33.39% | 5.17% | - | 5.17% |
| PZU | Insurance | 35.19% | - | - | 0.00% |
| SYNTHOS | Chemical | 62.46% | 5.03% | - | 5.03% |
| TAURONPE | Power | 30.06% | 5.06% | - | 5.06% |
| TPSA | Telecommunication | 49.79% | - | - | 0.00% |
| TVN | Media | 54.02% | - | - | 0.00% |

The figures in the table indicate the number of votes at the general meetings of shareholders.
OFE– Otwarte Fundusze Emerytalne [open pension funds]
FI – Fundusze Inwestycyjne [investment funds]
** - OFE are the largest shareholder
Source: Based on financial portals: money.pl, bankier.pl, 12 October 2012.

The ownership structure of WIG20-listed companies reveals only two types of institutional investors: open pension funds and investment funds. OFE hold over 5 per cent of share capital in 8 out of 20 companies under study while IF in only one WIG 20-listed company.

Analysis of the ownership structure of the companies under study leads to the question about the reason why the banks are absent among institutional investors. The answer is quite simple: Polish banks which are listed companies are specific entities. When foreign banks own the Polish banks they should be treated as strategic (industrial) and not institutional investors. Consequently, such investors are not considered in the ownership structure of the companies under analysis. Noteworthy, the ownership structure of WIG20-listed companies includes no insurance companies holding minimum 5 per cent of votes at a general meeting of shareholders.

Interestingly, there are no institutional investors in the ownership structure of 11 companies. A substantial block of shares is usually held there by the State Treasury, which is classified as an institutional investor by a number of authors (c.f. Table 1), but not in the classification adopted for this study.

In Poland, the insider system characterized by the concentrated ownership is applied, which means that an investor holding a controlling interest is in power to control the company operations. As regards the entities under analysis, institutional investors hold controlling interests only in ASSECOPOL and BOGDANKA, operating in IT and extractive industry. This

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[20] All public limited companies are obliged to make public the names of shareholders who hold 5 per cent of the total number of votes at a general meeting of shareholders.

means that institutional investors may affect operations of only 2 companies – they are in power to make decisions concerning critical affairs of the company and elect their bodies, as all resolutions are adopted with a simple majority of votes.

In other WIG20-listed companies, institutional investors do not hold minimum 5 per cent of the total number of votes at a general meeting of shareholders (11 companies), or they are company owners but a number of shares they hold is insufficient to control company operations (7 companies). Even if institutional investors decide to jointly accomplish the goals they set, and control a company, they would not be in position to affect company's management.

To sum up, institutional investors hold shares of the WIG20-listed companies but their bargaining power is insufficient to control company operations. Based on the pilot study conducted by us, it is possible to say that institutional investors do not play a crucial role and are unable to influence or supervise company operations.

**4 Conclusion**

We have focused on the essence, definition, and classification of institutional investors. The similar understanding of the term "institutional investor" by various authors does not translate into similar classification of the term. The differences in classification of institutional investors are a follow up of different financial systems in the world.

Preliminary studies on the ownership structure of the WIG20-listed companies show that the ownership structure of the public limited companies listed at the Warsaw Stock Exchange. However, institutional investors being owners of the companies representing the highest capitalization and trading volume only occasionally hold a controlling interest. In the majority of cases, even if all institutional investors from a specific company acted together, they would not hold a controlling interest and would not be in a position to influence resolutions adopted at general meetings of shareholders. We have decided to present the ownership structure of the WIG20-listed companies in order to study the role institutional investors in the Polish market and encourage further studies on this issue.

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# THE USE OF THE DIVIDEND DISCOUNT MODEL TO MEASURE STOCK PRICE VOLATILITY

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Abstract: The dividend discount model, shortly characterized at the beginning of the paper, belong among many models used to stock valuation. Various situations associated with zero, constant or variable dividend growth rate are described, including case of zero-dividend firm. The aim of the paper is to present the way how to use the dividend discount model to measure stock price volatility. Many subjects on financial market whether they generally analyse concrete stock markets or they directly create investment recommendations, can use this option in the practice. Findings resulting from realized empirical analysis can be rather beneficial for these subjects. Author also presents other ways how to use this model in the practice. It is also possible to compare the volatility and return related to one state with the same parameters related to other state, as it is mentioned in concrete examples.

Keywords: dividend discount model, stock price volatility, fundamental analysis, stock valuation, intrinsic value of a stock

## 1 Introduction

Many stock exchanges enable investors to invest in various securities including stocks. To find required information about stock, investors use various investment analyses including fundamental analysis. Many methods for estimating the intrinsic value of a stock is used. This value is described by Gottwald (2011) as the „justified price", which stock ideally should have and it express the real value of a stock. Investors use often the dividend discount model to calculate the intrinsic value of a stock. Based on it, they buy, hold or sell the stock. Stock price varies about the intrinsic value of a stock. To find the intrinsic value of a stock, financial analytics can choose from various models. Fundamental analysis provides itself a set of methods how to calculate the intrinsic value of a stock. Their choice depends on many parameters, which are needed for certain model.

The dividend discount model provides a means of developing an explicit expected return for the stock market. It is a way of valuing based on theory that a stock is worth the discounted sum of all its future dividend payments. In other words, the intrinsic value of a stock is expressed like present value of future dividends. The stocks are evaluated based on the net present value of the future dividends. The forecasting of future dividends is sometimes rather problematic.

Various types of the dividend discount model are used by the financial analytics. In the simplest case, the value of a stock equals to the value for a perpetual anuity with a constant level of payments. Other types depend on increasing, stagnation or decreasing of dividends. The increasing or decreasing of dividends can be linear or nonlinear. Financial analytics can estimate probabled increase rate of dividends by means of financial indicators of companies or historical data analysis. To analyse historical data, it is needed to find the availability of such data. The probabled increase rate depends on factors like dividend policy, margin of profit, return of equity capital and indebtedness.

The paper is structured as follows: At the first, author exactly defines objective and used methodology in Chapter 2. The dividend discount model, its modifications and various dividend policies are characterized in Chapter 3. This chapter also consists of empirical analysis focused on the use of the model to measure volatility of stock price. Author comments and discusses about the founded results in Chapter 4. Significant findings about using of the dividend discount model are concluded in Chapter 5. At the end, author mentions how it is possible to continue in the research in the future.

## 2 Objective and Methodology

The objective of this paper is to present the way how to use the dividend discount model to measure stock price volatility. The reason why is the objective so formulated consists in an effort to find out what is the real role of the dividend discount model, widely whether is it able to apply this model to this situation. The contribution is in using of presented method by subjects on financial markets. Analyzing stock prices by this method, subjects can more exactly create investment policy. As for the methodology, at the first various variance bound frameworks is used. Cross-sectional data are simulated from the general equilibrium asset pricing model. Also different time series paths of data corresponding to different state realizations are simulated.

Exact hypothesis is formulated. This hypothesis of the validity of the dividend discount model is further tested. As for statistical evaluation, F-tests are used in an effort to confirm or disprove that the variance of the actual price series is significantly greater than the variance of the perfect foresight price series. These statistical methods, described in the paper, are obviously used in these situations. Further, it is tested, whether markets are efficient, concretely, whether can be inferred any conclusions about market efficiency from variance bounds tests used within the research. Founded results from cited empirical researches are analyzed by analytical method. The dividend discount model including its various modifications are described by descriptive method. This model is used for illustration why stock prices may be highly volatile even though investors act in a perfectly rational way.

## 3 Results

### 3.1 Various Modifications of the Dividend Discount Model

Financial analytics use various modifications of the dividend discount model in the practice. The process for valuing stocks is commented by Blackwell, Griffiths and Winters (2007). The comment relates to stocks that pay dividends and stocks that do not pay a dividend. An investor in a dividend paying stock expects to recese two sets of future cash flows: a stream of future dividends and a sales price when the stock is sold.

To value a dividend paying stock, three various assumptions about dividend growth can be used: no growth in dividends, constant growth in dividends or nonconstant growth in dividends. However, the assumption of no growth in dividends may seem unrealistic. The assumption of constant dividends fits perfectly with the characteristics of preffered stock, which carries a stated dividend of a fixed amount. All preferred stock dividends must be fully paid before any dividend on common stock can be paid. Assumption of constant growth in dividends is reasonable for the large, stable, dividend-paying companies, which are often referred to as „blue chip" firms. By assumption of nonconstant growth in dividends is the growth rate in dividends generally assumed to decline to a rate of growth that is sustainable over the long run. Three-stage nonconstant growth in dividends is possible, too. Modifications like three-stage model or four-stage model are used in the practice. An intermediate stage of earnings growth exists between high growth and mature growth.

The use of the dividend discount model in case of no dividend payment by company is rather problematic. The value of the stock that do not pay a dividend is based on an infinite stream of expected capital gains. A standard conceptual method for valuing non-dividend-paying stock is the sum of cash flows from assets in place and cash flows from growth opportunities. It is also possible to use the indicator earnings per share to estimate the value of the stock. Nawalkha (2007) presents pricing zero-dividend and positive-dividend stocks. He derives stock valuation formulas for pricing positive-dividend and zero-

dividend stocks using alternative wealth creation models given as following: the residual income model, the EVA model and the franchise factor model. The dividends are obtained endogenously under these models, whereas in wealth distribution models like dividend discount model the dividends are obtained exogenously.

The assumption of the dividend discount model is that the value of an equity firm equals to the present value of all distributed dividends and this model focuses on the wealth distribution of the firm's resources in the valuation equation. The residual income model and the EVA model suggest that the price of the equity is the sum of the book value of equity and the present value of the residual incomes generated by the firm's returns exceeding its cost of equity. These models require the projections of future returns on the book equity. The franchise factor model requires the projections of future franchise returns on the increments to book equity. The techniques of estimating the growth variables under these three models are different.

Since book value growth variables may reflex fundamentals more accurately than the dividend growth variable, these three models may lead to better stock valuation than the standard dividend discount model. Nawalkha also derives formulas for zero-dividend paying stocks and dividend paying stocks under multiple growth rates.

Stock valuation is the theme, which Ross, Westerfield and Jaffe (2008) focus on. They mention differences among common, growth and preferred stocks. They also describe some special cases which depend on dividends growth, mainly zero growth, constant growth, nonconstant and supernormal growth. Capital gains yield and dividend yield are the components of the required return. Some features of common and preferred stocks, among others important characteristics of dividends are described, too. The choice of the suitable dividend discount model depends on dividend policy of a company. Ross and others describe standard method of cash dividend payment and the chronology of dividend payment. This theoretically explained chronology can be applied in the practice. They also identify the real-world factors which favor a high payout and a low payout of dividends. Described compromise dividend policy is often used in the practice by joint-companies.

**3.2 Stock Price Volatility Measurement by Means of the Dividend Discount Model**

Finding whether the stock price volatility can be justified by the dividend discount model and finding how big is the market efficiency, Salih, Akdeniz and Ok (2006) use cross-sectional data simulated from the general equilibrium asset pricing model. The model used in the study does not incorporate behavioral aspects of investors into asset prices. The model is solved for the optimal investment functions and for a given set of parameters, concretely for three firms and eight states of the economy using functional forms. In the end, 1000 different sample paths of market price data for 100 years is obtained. In each simulation, the computer starts from the same state. The perfect foresight price is calculated at discount factors from 1 % to 5 %. The descriptive statistics for the sample related to ratios used in testing are presented in Tab. 1.

Tab. 1: The Descriptive Statistics Related to Ratios

| Discount Factor | Ratio Mean | Ratio Standard Deviation | Minimum Ratio | Maximum Ratio |
|---|---|---|---|---|
| 0.01 | 6.29 | 3.50 | 1.61 | 20.38 |
| 0.02 | 3.70 | 1.75 | 1.07 | 10.58 |
| 0.03 | 2.81 | 1.14 | 0.91 | 7.23 |
| 0.04 | 2.36 | 0.83 | 0.84 | 5.40 |
| 0.05 | 2.08 | 0.65 | 0.81 | 4.39 |

Source: Salih, Akdeniz and Ok (2006)

Four parameters are analysed for each discount factor from 1 % to 5 %. The descriptive statistics for the sample related to other parameters used in testing are presented in Tab. 2.

Tab. 2: The Descriptive Statistics Related to Other Parameters

| Discount Factor | Utility Discount Factor | Number of Violations | Number of F Statistics |
|---|---|---|---|
| 0.01 | 0.99 | 1000 | 1000 |
| 0.02 | 0.98 | 1000 | 990 |
| 0.03 | 0.97 | 986 | 953 |
| 0.04 | 0.96 | 984 | 910 |
| 0.05 | 0.95 | 980 | 885 |

Source: Salih, Akdeniz and Ok (2006)

Based on results, number of F statistics relates to significant F statistics at 1 %. Furthermore, other parameters are founded, like production function parameters, distribution of ratio of standard deviation of price to standard deviation of perfect-foresight price and distribution of actual price. It is clear that the conditional variance bounds hold. Formulated hypothesis of the validity of the dividend discount model cannot be rejected, because the variance bound is not violated. Other important finding is that markets are efficient and stock prices are neither affected by herd psychology nor by the outcome of noise trading by naive investors. F-tests confirm that the variance of the actual price series is significantly greater than the variance of the perfect foresight price series in a majority of replications. The violation of the unconditional variance bound relationship does not necessarily indicate market inefficiency. Moreover, the variance bound relationship is essentially a cross-sectional restriction and should only be tested using cross-sectional data. That is the way how to measure stock price volatility.

Stock price volatility relates to stock market returns. The stock market mean returns and volatility spillover between stock markets of political and friendly countries are analyzed by Choudhry (2004). He selects potential friends and foes according to the political situations in the past ten years. The three pairs of foes tested are Israel–Jordan, India–Pakistan, and Greece–Turkey. The United States has been friendly toward these six countries. Spillover between the United States and these countries is also investigated. Nonlinear GARCH-t model is used to empirical tests. Based on results, there exists bidirectional mean and volatility spillover between two countries not on friendly terms. This spillover takes place from a larger distant friendly country - the United States - to these smaller emerging markets, but not much the other way around.

**4 Discussion**

The dividend discount model is usually used to stock valuation, in the practice. Various modifications of the dividend discount model were presented in this paper. These modifications depend on ways of dividend payments. New formulas for special cases of dividend payments can be derived from the basic formulas. Stock valuation of zero-dividend firms is also analysed. The relation between stock price volatility and the dividend discount model is researched by several researchers. There mentioned researchers used various models in their empirical analyses, especially the dividend discount model, the CAPM model, the residual income model, the EVA model, the franchise factor model and the Miller and Modigliani dividend irrelevance model. Theoretical explanation of changes in stock prices, in other words, volatility, is difficult, because many factors influence stock price volatility in the practice.

The surmise, whether is possible to use the results from the dividend discount model to measure stock price volatility, was researched. Based on used methodics nad founded results, this hypothesis was not rejected. Another look on the relation between the dividend discount model and volatility is described by Cuthbertson and Nitzsche (2008). At the first, analysing stock valuation, the dividend discount model is presented like rather simple model of valuation, which can be quite useful in

obtaining at least a ball-park estimate of the value of equity. This model can be used to illustrate why stock prices may be highly volatile even though investors act in a perfectly rational way and the market always prices stocks correctly. The stock market is excessively volatile, as the observed volatility in actual prices is greater than would occur if the markets were efficient and investors were always rational.

To analyse efficient markets hypothesis, the discount rate, which is used in the dividend discount model can be calculated. The rate is calculated using CAPM model. The research published in this paper can continue by various ways. To analyse the relation between the intrinsic value of a stock and stock price volatility, following models used to estimate the intrinsic value of a stock can be, in author´s opinion used: the profit model, combination of the dividend discount model and the profit model, the free cash flow to equity model (FCFE) and the historical model. The using of other statistical methods is also possible.

**5 Conclusion**

This paper confirms that the changes in stock prices can be measured by the dividend discount model. The way how to use the model is clearly presented. To describe dividend policy of companies, it is need sometimes to modify this model. Author completely describes various situations related to various dividend payment strategies. Methodics used in the paper can be beneficial for many subjects on financial market. These subjects can more exactly create their investment policy. The testing of the market efficiency is described, too. The dividend discount model is also used to illustrate of high volatility of stock prices even though investors act in a perfectly rational way. It is possible to continue in the research by other applications of the dividend discount model in various situations.

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**Primary Paper Section:** A

**Secondary Paper Section:** H

# CAVIR: CORRESPONDENCE ANALYSIS IN VIRTUAL REALITY
# WAYS TO A VALID INTERPRETATION OF CORRESPONDENCE ANALYSIS POINT CLOUDS IN VIRTUAL ENVIRONMENTS

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Abstract: Correspondence Analysis (CA) is frequently used to interpret correlations between categorical variables in the area of market research. To do so, coherences of variables are converted to a three-dimensional point cloud and plotted as three different 2D-mappings. The major challenge is to correctly interpret these plottings. Due to a missing axis, distances can easily be under- or overestimated. This can lead to a misinterpretation of data and thus to faulty conclusions. To address this problem we present CAVIR, an approach for CA in Virtual Reality. It supports users with a virtual three-dimensional representation of the point cloud and different tools for analysis and clustering. Besides, the free rotation of the entire point cloud enables the CA user to always have a correct view of the data.

Keywords: interaction techniques, user interfaces, exploratory data analysis, correspondence analysis, virtual reality, clustering, market research

## 1 Introduction

Correspondence Analysis (CA) is a descriptive dimensionality reduction method of multivariable statistics which allows a vivid graphical representation of complex correlations of two (or more) categorical variables as a point cloud in a (theoretically) three- (or more) dimensional space. Similarities between variables are converted into distances on three or more dimensions, and the positions of the variables, represented by points, are converted into coordinates. It is presumed that there is a dependency between rows and columns which can be explained by latent variables. Later on, the variables will be presented as a three-dimensional point cloud. The three axes can then intuitively be interpreted as these latent variables. CA is widely used in social science, psychology, medicine, and in the area of market research (Backhaus et al. 2006).

### 1.1 Key Concepts of Correspondence Analysis

The key concepts of CA, which are necessary for understanding the functionality and terminology of CAVIR, are briefly introduced[1]. The database consists of frequencies $n_{ij}$ in a contingency table $K$ with $I$ rows $R_i$ and $J$ columns $C_j$ (Table 1).

With $N = \sum_i \sum_j n_{ij}$ and $p_{ij} = \dfrac{n_{ij}}{N}$ , $P = \begin{pmatrix} p_{11} & \cdots & p_{1J} \\ \vdots & \ddots & \vdots \\ p_{I1} & \cdots & p_{IJ} \end{pmatrix}$ is the matrix of relative frequencies.

Table 1: A *IxJ*-contingency table is the dataset the correspondence analysis is based upon.

|        | $C_1$    | $C_2$    | ...  | $C_J$    | $\sum$ |
|--------|----------|----------|------|----------|--------|
| $R_1$  | $n_{11}$ | $n_{12}$ | ...  | $n_{1J}$ | $r_1$  |
| $R_2$  | $n_{21}$ | $n_{22}$ | ...  | $n_{2J}$ | $r_2$  |
| $\vdots$ |        |          | ...  |          | $\vdots$ |
| $R_I$  | $n_{I1}$ | $n_{I2}$ | ...  | $n_{IJ}$ | $r_I$  |
| $\sum$ | $c_1$    | $c_2$    | ...  | $c_J$    | 1      |

We define $r_i = \sum_{j=1}^{J} p_{ij}$ and $c_j = \sum_{i=1}^{I} p_{ij}$ , as the masses of rows and columns. The frequencies in the cells are normalized with $r_i$ and $c_j$ respectively. As a result we get two matrices

$$R = \begin{pmatrix} \dfrac{p_{11}}{r_1} & \cdots & \dfrac{p_{1J}}{r_1} \\ \vdots & \ddots & \vdots \\ \dfrac{p_{I1}}{r_I} & \cdots & \dfrac{p_{IJ}}{r_I} \end{pmatrix} \text{ and } C = \begin{pmatrix} \dfrac{p_{11}}{c_1} & \cdots & \dfrac{p_{1J}}{c_J} \\ \vdots & \ddots & \vdots \\ \dfrac{p_{I1}}{c_1} & \cdots & \dfrac{p_{IJ}}{c_J} \end{pmatrix}.$$

Each row of $R$ is called the $i^{th}$ row profile of $K$. Each column of $C$ is called the $j^{th}$ column profile of $K$ (Mortensen 2011). The columns, interpreted as $J$ axes, put up a $J$-dimensional space $C_J$ , which the row profiles should be plotted in, analogously to the rows. Obviously, the $J$-/$I$-dimensionality causes problems, since plotting more than three-dimensional spaces makes an understanding of the mapping more difficult. Due to this, the number of dimensions of $C_J$ and $R_I$ is reduced to three ($C^3$, $R^3$) and both are integrated into one coordinate system, whereby three conditions have to hold:

1. The more similar the profiles are, the closer the points representing the respective row/column should lie to each other in the coordinate system. The distance is measured using the Euclidean distance.
2. The reduction of the overall variance of $K$ overall $p_{ij}$, the so-called Total Inertia $T$, should be minimal, while $T$ is given as

$$T = \sum_{i=1}^{I} \sum_{j=1}^{J} \frac{(p_{ij} - r_i \times c_j)}{r_i \times c_j} .$$

3. The additive decomposition of $T$ should be maximal (Mortensen 2011).

After further calculations we get *XYZ*-coordinates for each row and column, so points can easily be plotted (cf. fig. 1(a)). The axes of the integrated space can be interpreted as latent variables that explain the variance of the conditional frequencies.

### 1.2 Challenges of Plotting CA Point Clouds

The reason why CA is so widely used in social science and market research lies, i.a., in the relatively convenient way complex correlations between categorical variables can be intuitively interpreted using "mappings" (cf. fig. 1(a)). With a mapping, the researcher interprets the relative distances of the points from each other and their relative positions on the axes. Most often, one column point (■ in fig. 1(a)) makes up more or less the center of a sub-cloud consisting of several row points (● in fig. 1(a)). In market research, the column points usually represent variations of a product, brands, or firms, and the row points represent features, ratings, or (potential) purchasers (Backhaus et al. 2006). Column points will henceforth be referred to as "trait carriers", and row points as "traits". Sometimes, researchers use the mapping to cluster points graphically.

For a complete plotting of results, a coordinate system with three axes is required. This poses some difficulties, as a valid graphical representation may ultimately be two dimensional. Plotting software solutions (e.g. SPSS, mapwise, XGobi) therefore usually offer the option of plotting three different mappings, where one of the three axes is omitted. Hereby, both an *XY*-, an *XZ*- as well as a *YZ*-coordinate system are produced (Swayne et al. 1998), (Nenadic and Greenacre 2007). For the interpretation of results this may cause problems because only two axes can be considered simultaneously. This is why practitioners often choose the axes with the highest explained variance and ignore the third one and thereby neglect important distance information.

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[1] For detailed information, see (Mortensen 2011), (Benzécri 1977) or (Backhaus et al. 2006); for a short introduction, see (Nenadic and Greenacre 2007).

(a)                                                                                      (b)
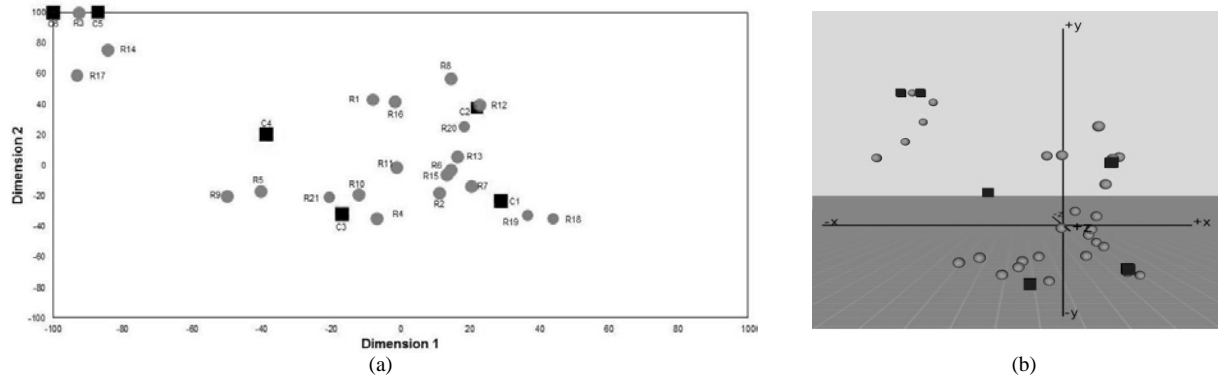
Figure 1: Comparison of the CA point cloud representation in a two-axis coordinate system with a simple 2D-mapping (layout similar to SPSS) (a) and in a three-axis coordinate system with our VR-based approach (b).

Figure 2 shows an example of how a missing dimension can cause invalidities in the graphical representation. In the tables 2 and 3 the respective coordinates and mean Euclidean distances are given. It becomes obvious that the distance between point F and point 5 is massively overestimated if only the axes *X* and *Y* are taken into account. The distance is reduced from 30,9 to 21,4 when axis *Z* is included into the calculation of the (mean) Euclidean distance. Analogously the distance between point C and point 2 is heavily underestimated in the 2D-mapping, because the mean Euclidean distance increases from 14,8 up to 56,8 when the *Z*-axis is included into the calculation.

This invalid representation of distances in the 2D-view can easily lead to a faulty clustering of data, which is dangerous. The aim of CA is (as discussed above) to show graphically which row points (traits) are associated with which column point (trait carrier) in the perception of potential customers. Faulty clustering so can lead to wrong interpretations of these associations and foster invalid conclusions in the manner that e.g. a point is included into one cluster but truly belongs to another one. In the worst case such errors can e.g. let a PR-campaign fail because traits of one product are stressed though they are – according to the customers perception – not in the least associated with this product.

Table 2: *XYZ*-coordinates of example points in figure 2

| Point | Coordinates | | |
|---|---|---|---|
| | **X** | **Y** | **Z** |
| F | 45,9 | 8,3 | -42,3 |
| C | -24,8 | 6,2 | 100,0 |
| 5 | 6,0 | -38,8 | -59,6 |
| 2 | -0,2 | -10,4 | -67,7 |

Table 3: Mean Euclidean distances of example points in figure 2

| Points | Mean Euclidean Distance | |
|---|---|---|
| | **XY** | **XYZ** |
| F, 5 | 30,9 | 21,4 |
| C, 2 | 14,8 | 56,8 |
| C, 5 | 27,3 | 56,2 |
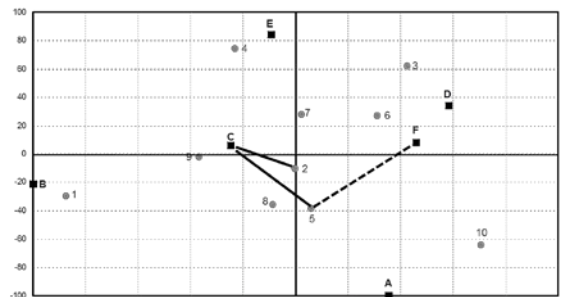


Figure 2: Underestimation (——) and overestimation (- -) of point distances in a 2D-mapping. Z-Axis not plotted. (Variance explained: x-Axis = .46 / y-Axis = .31 / **z-Axis = .22**)

To sum up, the main problems with non-three-dimensional plottings of a CA point cloud are:
1. Overestimation of distances
2. Underestimation of distances
3. Faulty clustering
4. Faulty interpretation

Several attempts to take account of all the three axes graphically have led to unsatisfactory results. Especially, the graphical summary of points into clusters is impossible when distance information is not realized validly as distances but rather as perspectives or as point characteristics.

**1.3 Approach**

In the work presented, the authors have developed CAVIR, a tool that enables the graphical analysis and interpretation of CA point clouds in a virtual environment (VE), providing a valid distortion-free impression of the spatial distances between points. To meet the challenges mentioned above, the key approaches to a solution are:
5. A virtual three-dimensional model of the CA point cloud
6. Free navigation through the VE
7. Arbitrary rotation opportunities of the point cloud to provide a valid impression of the spatial distances between points
8. Diverse options to display labels
9. Unhindered scaling of axes
10. Measuring of distances between points
11. Clustering of points

**2 Related Work**

Van Dam et al. already stated that the gap between the rate of data generation and the capacities to analyze this data is widening. As a possible solution they propose Immersive Virtual Reality (IVR) technology, which combines interactive visualization with immersive sensation (van Dam et al. 2000). Arns et al. integrated 3D-scatterplots into a CAVE-like VE (Arns et al. 1999). The authors performed a user study which contrasted their methods with the well-known XGobi system (Swayne et al. 1998). Interestingly, users performed better with the VE but felt more comfortable when working with the classical desktop-based tool.

Another approach that uses a "grand tour" view embedded in a VE to show raw data as well as clustering results is presented by Yang (Yang 1999). The same author specifically addresses the problem of overdrawing, and presents a solution based on direct volume visualization, namely a splatting approach for scatterplots and similar views (Yang 2003).

Very little research has yet been done on alternative ways of plotting the point cloud of a CA. Backhaus et al. give an introduction in the method itself and its mathematical procedures, pointing out that if more than two axes are needed to achieve a satisfactory explained variance, the researcher has to decide which two are the most important. These should be plotted. However, the authors admit that a two-axes-plotting is never possible without a loss of information (Backhaus et al. 2006). Whitlark and Smith propose chi-square residuals to

measure item distances (so-called attribute-brand relationships) and to thus escape the dimensionality problem. Previously they had stated: "Relying on a two-dimensional map may be risky. In our experience, it is rare to see a two-dimensional map tell a complete or even an accurate story" (Whitlark and Smith 2001). The statistical software package R, as described by Nenadic et al., provides a non-immersive three-dimensional display of CA point clouds, which alleviates (but does not totally solve) the problem of perceptual distortion. Helpful analytical tools, such as brushing, labeling, distance measuring, and clustering, are not included in R (Nenadic and Greenacre 2007).

The first application of Virtual Reality (VR) on CA was done by Monmarché et al. In the context of a dermatological study, they plotted point clouds along three dimensions of skin characteristics using a stereoscopic display. Point clustering was ex ante implemented by a hierarchical cluster analysis (Monmarché et al. 2002). However, we want to enable the researcher to cluster the points manually within the model. In contrast to existing CA analyzing and visualizing tools, the approach presented here proposes an immersive 3D-display providing the researcher with a distortion-free impression of spatial distances as well as with new interaction methods for valid interpretations and clustering.

**3 Technical Realization**

CA is a complex process divided into several substeps, but in this paper we focus on one of the last steps, namely clustering and the supportive techniques. Due to the fact that the approach should be embedded into the workflow of CA experts, the format of our input and output files is determined by the notation of SPSS (Akin et al. 2009), one of the standard programs in the field of CA. This enables a quick and uncomplicated switch between both working areas.

Our initial situation is an input file containing a list of data points described by three attributes: one character **cMemshp** classifying the data point, one string **sDesc** giving a concrete point label and three numerical values defining the position of a point **P** in the 3D space.
The data points are divided into two sets, the traits **A_Trait** and the trait carriers **B_Carrier**. The data points' membership of one of these two sets is encoded in *cMemshp*. A unique natural number indicates the inclusion in *A_Trait*; unique small letters, accordingly, in *B_Carrier*. To be able to cluster the data points meaningfully, users need to be able to easily distinguish both sets during exploration in the VE. For this purpose, different shapes, analogously to the representations in standard 2D-CA-programs, are used: a sphere is chosen for the traits and a box for the trait carriers (cf. fig. 1(b)). With this similarity, irritations on the user side will be avoided. Then, the representations are shown at the respective point *P*. A Cartesian coordinate system used as a reference frame (see 3.3) completes the basic set-up.
Due to the fact that the point cloud is relatively small compared to the complete VE, we added a tiled reference plane as a "ground floor" to give some spatial cues. This supports the user during exploration of the scene via navigation (Bowman et al. 2004). Here, we offer two techniques: a pointing-metaphor for free travel through the VE and a trackball metaphor for free rotation of the point cloud.

**3.1 Interaction**

In addition to navigation, different interaction techniques are offered. We scale the represented point clouds to enable an accurate selection with both techniques of a single point, even in tight clouds. To give some additional help by all selection tasks, the position of the input device is displayed by either a beam or a small sphere, as will be explained in section 4.
To enable an intuitive and well-defined handling, each technique provided is bound to one application mode. A menu hierarchy is used to for unhindered switching between the modes and their submodes during runtime. We choose a so-called *pie menu* (Callahan et al. 1988).

Besides the layout, we try to achieve an effective working by using just a small menu hierarchy. The first menu consists of four entries, showing the four available modes, presented in the following. Each entry has a submenu for mode specific tasks. To always indicate which mode is currently active, we show a tooltip that provides all the necessary information. Additionally, a color coding of the floor tile borders and the scene background is used. These colors are also linked to the respective circular menu's entries to quickly ensure a correct handling.
Besides the different shapes, we add a color coding for an easy and quick identification of the points' membership. Traits are visualized in red and trait carriers in green. This color association is reused as often as possible in the modes.

**3.2 Labeling**

Besides the general set-up, additional information is required for an effective clustering process. We use textual annotations, as shown in figure 3(a), which can be faded in or out for each point individually in the "label" mode. For simplification, we use the red-green coloring here, not only for the points but also for the labels.
We provide three label types, given in the initial input file, which are used to support the user during clustering.
1. The unique id *cMemshp* allows an explicit and a fast identification of data points.
2. Sometimes it may be useful to know what information a point represents, i.e. which product or key features it stands for. This information is contained in the attribute *sDesc*.
3. The explicit point position is also helpful during clustering to estimate point distances without using the distance mode, or to find outliers.

Users can switch between those label types via different entries in the circular menu.

**3.3 Coordinate System**

To quickly understand the distribution of the point cloud, we display a Cartesian coordinate system with labeled axes. Due to this, the origin of the point cloud can be clearly identified and this allows a first, rough classification of the distribution. To allow extraction of more information, the length of the individual positive and negative axis intercepts can be set to one of three predefined values using the mode "coordinate system".
- To quickly understand the spatial distribution, the axes can be adapted to the *maximal absolute values* of the point cloud extended by a user specified value. Short axes imply small point distances, while large axes indicates an extensive distribution or outliers.
- In CA, points are often deemed to be outliers if they have at least one absolute value greater than a maximal bound. According to the concrete application, those values may be treated differently, e.g. they may be clamped to a special value. In our approach a maximal bound can be predefined by the user to enable the identification of outliers.
- In addition to the maximal bound, a minimal bound can be set. This value will be predefined by the user and used to quickly identify points in or over a special bound.

Besides scaling the axes, users can add an object-oriented bounding box to identify inliers and outliers more clearly.



(a)

(b)



(c)
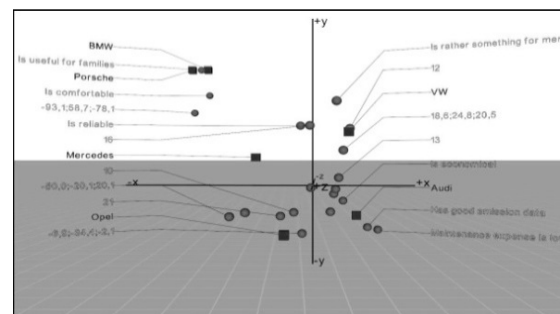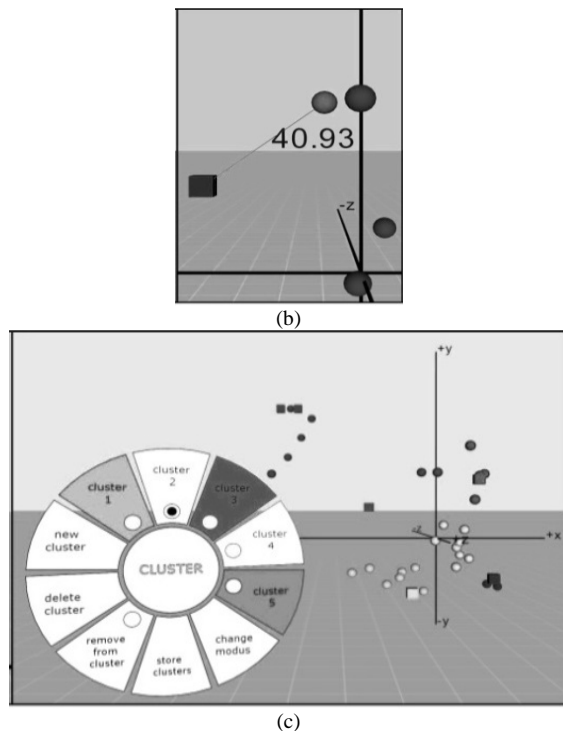
Figure 3: (a) The label layout consists of two columns next to the point cloud and different labels are offered, which can be selected individually for each data point. (b) A measured distance is visualized via a connecting line and a centered text label. (c) One example to divide a given point cloud into five clusters, currently adding points to cluster 2.

### 3.4 Distance Measurement

The main aim of our approach is to facilitate clustering and to reduce errors during this process. One criterion used to find the correct cluster for a data point is comparing the distances between several points. This can be done in the mode "distance". Users are asked to select two different data points $P_i$ and $P_j$, between which the Euclidean distance will be computed. The Euclidean distance itself is calculated based on the exact coordinates given in the input file.

Figure 3(b) illustrates the distance visualization: a connection line between both selected points, and a centered label with the computed distance. To maximize the clarity of which points are selected, all points are inked in gray in the beginning. After selecting a data point, it is recolored to red or green according to the set it belongs to.

Users can select a marked point again to deselect it, or just choose a third point $P_k$. In this case, the system will automatically deselect the first two points $P_i$ and $P_j$. Owing to this, just one distance is shown at the same time.

### 3.5 Clustering

In the "clustering" mode, the whole interaction is managed by the circular submenu, shown in figure 3(c). Thereby, the compliance of two rules is always ensured:

*R1*: The total number of clusters is greater than zero and less or equal to |B carrier|.

*R2*: In each cluster there has to be at least one trait carrier.

Three interaction types are offered in this mode:

a) Users can add and delete clusters, complying with R1. For each cluster an individual menu entry is provided, containing a radio button.

b) Via brushing (Wright and Roberts 2005), points can be linked to an active cluster according to R2 or they can be removed from any cluster.

c) The clustering can be stored to the file system. The format of the output file is determined as dummy codes, to enable

the analyst to go on working in her used surroundings after using the VE to cluster the point cloud.

If the user selects a cluster entry in the circular menu, linking of data points to the according cluster is activated. Adding points to the cluster is done by brushing: first focus a point, and then add it by clicking. To be able to comply to R2, the first point added to a new cluster has to be a trait carrier. We again use colors to show the set membership. All points that are not yet linked to a cluster are gray. Each cluster has a unique color, which is used for the cluster entry in the circular menu and the linked points. Traits that shall be linked to several clusters will be marked multicolored. Additionally, cluster membership is coded by a tube-like respectively colored silhouette. If the user adds a point to a wrong cluster, the circular menu provides an entry for deleting individual points from clusters. With this option, the points are recolored gray. If a single trait carrier in a cluster is deselected, all points of this cluster are deselected, too. With this automatic deselection, R2 is always ensured to hold.

### 4 Challenges of Different VR Displays

The aim of CAVIR is to accelerate the process of interpreting and clustering and thereby reduce the potential clustering errors described in section 1. Arns et al. (1999) already showed in a user study that VEs support this requirement, because a third dimension is available. Users are able to make better decisions, due to a better and not misleading view of the data (Whitlark and Smith 2001).



(a)



(b)
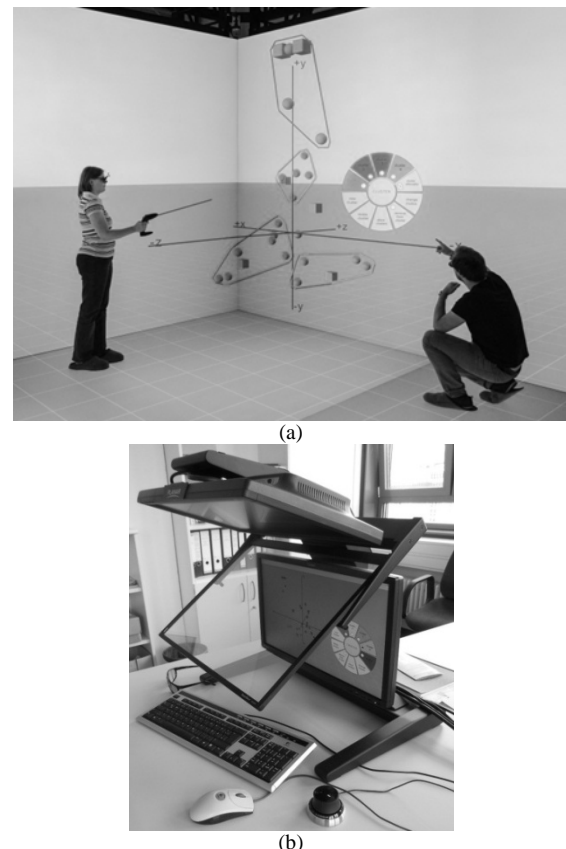
Figure 4: (a) Using CAVIR in a five-sided CAVE-like environment (here: aixCAVE at RWTH Aachen University) and (b) on a 3D monitor without head-tracking.

Our approach should be available for two different display system classes. On the one hand, we want to use a five-sided CAVE-like environment to enable collaboration with several people during the cluster process and the possibility to freely walk around the point cloud (fig. 4 (a)). On the other hand, we want to provide a semi-immersive low-cost and quick possibility to cluster the point cloud in the office in order to embed its use

into the normal workflow. Therefore, we decided to use a 3D monitor, as shown in figure 4(b).

The low-cost solution has multiple advantages. First, it is easy to handle for novice users, who are often not familiar with VR techniques. Second, all the input devices known from standard desktop systems can be used and thus the interaction can be maintained similarly to the usual work environment. Due to this, the learning phase before users can handle the application correctly is shortened.

**5 Discussion and Future Work**

We have presented a VR-based technique to ease valid interpretation and to realize clustering - one of the last steps in correspondence analysis (CA). The standard CA programs mostly provide 2D-views of the data, leading easily to misclustering and misinterpretations None offers a clustering option. In the virtual environment (VE) we have the advantage of showing the data three-dimensionally as a point cloud in a Cartesian coordinate system. Thus, a correct view is always provided and perceptual distortion avoided, which accelerates the clustering process and at the same time reduces the risk of invalid clustering and misinterpretation. Different navigation and interaction tools are used to support the clustering, which is done by linking points to certain clusters via brushing.

During the implementation process we had close contact to one CA expert, who pretested all features. However, we plan to evaluate our approach in a user study to identify issues which need to be addressed for improvement, especially concerning usability.

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# THE TEACHER AND THE CHALLENGES OF THE INTERPRATATIVE APPROACH TO LITERARY EDUCATION

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Abstract: Certain intensive challenges have been set before the teachers lately concerning literary education. While the status of literary education has dramatically changed in recent years, the tradition of literary education in Czech schooling system remains very firm. Fact-oriented, literary-historical, scientific. A contradictory tradition has been crystallizing for almost a hundred years – an innovative approach that can be described as interpretative, reader-oriented, experiential. Both approaches differ the most with respect to high school education, however, traditional approach, by nature, also influences lower elementary education. While a lower elementary school teacher can combine both approaches to get the best results, a high school teacher can no longer walk both the road of quantity and quality.

Keywords: Teacher, literary education, literary educational conception, teaching tradition, interpretative approach, non-interpretative approach.

## 1 Introduction

We believe that certain very intensive challenges have been set before the teachers lately concerning literary education.

They are by far not only challenges related to the transformation of the Czech schooling system, or official and explicit demands, e.g. through the Framework Education Programs or School Education Programs, but also to a deep, global transformation within contemporary society.

It appears that current era diminishes faith in the written, but also the spoken word, in favor of the visual. The visual is ubiquitous, self-evident, undeniable. Our world is considerably faster and more uncompromising than it used to be: the speed of life and material demands leave almost no time for reading, let alone reading detailed, attentive and literarily privy.

Literature itself has also lost its privileged cultural position; before, a writer used to speak for the whole nation, and the nation considered him its voice, in contemporary society, every author speaks only for himself. With the diminishing prestige of literature, the prestige of literary education, and therefore school literary education, has also weakened.

While the status of literary education has dramatically changed in recent years, the tradition of literary education in Czech schooling system remains very firm. Fact-oriented, literary-historical, scientific.

Literary education has never achieved the status of a true aesthetic education in the Czech schooling system, even though the disputation about the need of transcending the purely scientific approach has been present at least since the 20s (compare for example Mathesius 1992; Mukařovský 1925) and has been growing in intensity since the 60s (for example the magazine *Český jazyk a literatura*).

We are left with the question if, and to what extent, can the traditional, scientific approach to literary education retain its position in the face of the dramatic changes of contemporary reforms and societal changes as such. To what extent do we need a new, innovative approach, which can by called interpretative, experiential, reader-oriented, and what requirements does such an approach put on the teacher. In our article, we are focusing on the third, last question, but we also feel obligated to answer the second one as well.

It is also necessary to point out that the traditional, scientific approach is not connected only to high school, but also lower elementary school education. For this reason we are addressing challenges related to the lower elementary, upper elementary and high school teaching.

## 2 Lower elementary education

A lower elementary school teacher obviously works in conditions which are very favorable of the interpretative, experiential approach to literary education. This approach is by its nature closest to the children's attitude, since it can easily connect with their imagination and the strong desire to experience, try and create.

The approach to literary education at the lower elementary level is different in the first two grades and the subsequent three. In the 1st and 2nd grade, the aim of literary education – in accordance with the name of the subject, *reading* – is mastering reading as a skill. In this period, the teacher's attention is focused on mastering and developing reading skills. In the subsequent years, the attention is split between additional reading skills and an introduction to elementary layers and functions of a literary (but also factual) text.

The differences in content (based on the differences in the educational aims) in the first and the second period put different demands on the literary education teachers.

In the first two years, the teacher, who always works with a text, has to use the texts to acquire and develop reading methods and skills. By this we mean simple, basic interpretative activities (see below) which help the students understand the text, but also for example many cultural contexts.

Direct work with a text is motivating for the student, and naturally leads to a more effective acquisition of reading skills and reading literacy. The teacher himself has to be creative in the selection of the text (he is always the first reader) and working with the text in class. A lower elementary school teacher is challenged to find such a text that will, by its nature, make the introduction to reading easier and that can interest the students repeatedly.   He also has to construct the (elementary) interpretative lesson with the aim of understanding the text, including intuitive understanding of its basic layers (for example composition, language and style etc.) but also a strong reading experience in mind.

From the third year, one of the aims of literary education is to adopt elementary literary terms, but this aim can also be achieved in other ways than through the traditional, terminology-oriented approach. Understanding of basic literary terms is also possible through a direct, creative and interpretative work with the text. An example of basic interpretative activities for adopting the terms *rhythm and rhyme* would be for example filling in words into a poem or finding redundant words in the text (intentionally added by the teacher), etc.

Teachers who have decided to use the interpretative approach to literary education can find great help in dramatic activities and creative dramatic methods.

Methods and techniques of dramatic education use literary text to mediate the experience that the text itself provides. Creative, personal approach to a literary work provides permanent acquisition of knowledge and the possibility of a subjective interpretation of the literary work's form and content. Dramatic methods fully respect the demands of the interpretative approach to literary education.

Even though a lower elementary school teacher often „supplements" the interpretative approach to literary education with the traditional one, especially in the last years of the lower elementary education, it is the interpretative approach that is, from the point of view of the educational aims, indispensable

and quite essential. The lower elementary school environment is also a natural environment for creativity, imagination and fantasy. However, if we were to answer the question which of the two approaches is professionally and personally more demanding on the teacher, we would have to say it is the interpretative, reader-oriented, experiential.

**3 Upper elementary education and high school**

**3.1 Introduction**

The above mentioned discrepancy between the two approaches to literary education becomes even more prominent in the later years of study; whereas with the lower elementary education, many teachers utilize experiential, interpretative, reader-oriented approach to literary education, and accept it because of its „playful" and creative character, natural for younger children, and use this approach for example together with the traditional one, scientific, non-interpretative, at high school, we can observe a certain irreconcilability between the two approaches, because they are both different in terms of aims, contents and methods.

Hints at the surviving historicism and factualism of the traditional approach, especially at high schools, can be found even in the works of otherwise relatively optimistic methodists of literary education (see Řeřichová, 2004 a Vala, 2011), „*In the last years, the reader-oriented approach with aspects of experiential learning has become more prominent at elementary schools, however, this development is much less noticeable with respect to high schools.* " (Vala, 2011, s. 14)

**3.2 Upper elementary literary education school teacher**

An upper elementary school teacher who decides to utilize the interpretative approach to literary education, that is the innovative direct work with a text, is much more than his lower elementary colleague confronted with the curriculum volume. From the point of view of a naive observer, the question could be formulated for example like this: *How to go through all the important authors, but at the same time pay enough attention to live work with the text and reading experience?* However, for an experienced and self-reflecting teacher, this questions contains a multiple paradox:

1. As a teacher, I do not really have to go through all the important authors. A binding collective body, which determines the authors and their works, exists only notionally. The school education program also defines only the framework and the expected outputs, not lists. A large number of teachers unnecessarily cling to the old quantitative curriculum.

2. It is up to me as a teacher to choose which path I want to take: fewer texts, which will be delved into in depth, or going through a larger amount of texts and authors, but with lesser depth. (this is a problem of both educational content and method)

We therefore believe that the solution to the problem of volume is fully in the hands of the teacher.

The real problem is the methodology, that is how to construct a reader-oriented, interpretative lesson. Such a lesson should be rooted in the work with the text (and therefore the reading experience). In the interpretative approach, the teacher can no longer do with a text that merely proves statements communicated in advance. The text must become a cornerstone of further efforts.

A meaningful interpretative literary education lesson also cannot merely work with a text, not even creatively. It is reflection (reflective dialogue), based on this work, that brings meaning to the innovative approach. Through reflection (in hindsight) the students discover relationships and natural rules, which by their nature would either not be possible to be discovered through the

traditional approach, or they would be merely verbally conveyed in a simple enumeration and written out on the blackboard. The possibility of experience and reflection is by itself a very strong motivational tool. Motivation is often a problem for the teachers who prefer transmissive educational model and frontal education.

A teacher of literary education who chooses the interpretative approach must construct such a lesson that would place the same importance on the students´ creative production and on reflection (see Slavík 2001). Creative activities often have an experiential aspect, and the teacher must be able to accept the role of a partner, guide, or a coordinator of student's activities. Such a teacher must however posses a natural respect that is not forced and must often reevaluate his relationship to the students and the educational content.

It is quite clear that a teacher, who meticulously thinks through the construction of the lesson, text selection, the work with the text, who decides how to prepare the situation for a particular experience (reading experience as well as creative experience) and the subsequent reflection, must spend considerably more time on preparation for the lesson than a teacher who favors the traditional approach, for example a lecture on literary history or theory or a lecture followed by reading of an extract from the text without (deeper) reflection. The same is true for the lesson itself, which requires a creation of creative climate, the ability to participate in a discussion with the students, to lead the discussion but also transforming suggestions for further innovations etc.

**3.3 High school literary education teacher**

The high school teacher often feels responsible for the students´ preparedness for the final exam and both the school and the parents place a considerably stronger pressure on him then on his colleagues from upper elementary school. However, it is also important to realize that the primary purpose of a school system is to prepare the students for life. That is why we must not limit our efforts to a simple mastery of (any kind of) exams and resign on the higher aims of education. A mere factual drill (for example the state exam test) can never be identified with a meaningful literary education. This would be valid to some extent only if the official exams respected the highest educational aims, which is however very unrealistic.

A high school teacher should feel true responsibility for his students as intellectually independent beings, nurtured towards humanity, as the main and most general aim of education is „*making a person able to live their life in an independent, socially responsible, meaningful and good way.*" (Brezinka, 1996, p. 38)

More so than his colleagues from elementary school, a high school teacher must, if he wants to employ the interpretative approach, deal with the problem of reducing the educational content. He must carefully consider into what depth he wants to delve in the interpretation and reflection of the literary works, and therefore which authors and works, included for example in textbooks, he has to omit.

A high school teacher has to clearly choose between quality and quantity; there is essentially no compromise, as the teacher who chooses to go the way of quality, direct work with the text and reflection, necessarily encounters the fact that simple notes about a particular literary work / text, synopsis of the content, or its rephrasing, cannot supplement direct, lively work with the text and the knowledge gained from such an approach. Without confronting the reading experiences of the students – their preconceptions about the fictional world of the text – adequate understanding of the literary work cannot be achieved. (see Doležel, 2003.)

The teacher who is aware of the fact that students need to acquire knowledge of a permanent nature, knowledge rooted in

personal experience (in the case of literary education working with texts, as this is the very content of literary education) chooses the qualitative approach, which, in our, intentionally escalated rendition, correlates more with interpretative, reader-oriented, experiential approach.

The teacher who decides to employ the interpretative approach to literary education in no way resigns on acquiring general knowledge, cultural and historical context, memory. However, it is true that interpretative approach favors aesthetically-scientific understanding rather than the factual, biographical knowledge. If we accept the fact that the content of literary education consists of texts, then the aesthetically-scientific understanding is fully legitimate and indispensable, and is only expanded by biographical knowledge. The interpretative understanding is tied to a lively reading experience, direct work with the text, and therefore allows the students to better understand textual relationships, acquire skills, and form attitudes than the purely factual approach. While the traditional, factual approach focuses on *knowing about literature*, the interpretative, reader-oriented and experiential approach focuses on *direct work with literature* and knowledge, skills and attitudes, acquired by *understanding literature.*

**4 Conclusion**

A lower elementary school teacher who decides to employ the interpretative approach is challenged to search for texts which have a potential of expanding elementary reading skills and basic reading methods, texts that can interest the students repeatedly. He must carefully consider the elementary interpretative activities and construct the lesson in a way that combines the development of basic reading skills with understanding of the meaning of the text. Aside from the literary education exercises, a large focus is also put on a holistic development of the child.

An upper elementary school teacher is required not to abandon direct work with the text, which relates to children's natural curiosity and creativity, even though he is confronted with a larger volume of information than his lower elementary colleague.

A high school teacher must deal with the pressure created by the final exams, the school's policy, the parents and the public. Should he decide to employ the innovative, interpretative approach to literary education, he must not resign on direct work with the text as the cornerstone of gaining knowledge. He is challenged to responsibly choose into what depths he wants to delve regarding text interpretation and if and how he wants to reduce the curriculum.

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# COST ANALYSIS AND ASSESSMENT IN THE POLISH HARD COAL MINING INDUSTRY IN YEARS 2006-2011

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Abstract: The purpose of the hereby article to analyze and assess costs in the Polish hard coal mining industry in years 2006-2010 during the period of economic improvement on the market of traditional energetic resources. It is an issue which significantly affects the competitiveness of Polish coal on the world markets. In the light of the results, the improvement of competitiveness will be possible if the salaries rise is decreased and also the effectiveness of employment restructuring is improved.

Keywords: cost analysis and assessment, Polish hard coal mining.

## 1 Introduction

The hard coal mining industry is a branch that until recently has been thought to be in the stage of decline. However, in the last 3 years the sector has begun to experience revival due to the increase in demand on traditional energy resources. Together with this revival the chances of Polish hard coal mining industry surviving or even developing are rising. However, their realization depends on the competitiveness of Polish coal on the global markets. The competitiveness on the other hand is decreased by unit costs of production that are growing in time.

Due to the importance of this problem, in this paper the production costs of in Polish hard coal mining industry in years 2006-2011 have been analyzed and assessed. The objective of this paper is to determine the scale of changes in production costs as well as their reasons. The results can be used in further stages of cost management in order to improve the efficiency of Polish mining industries.

## 2 The analysis and assessment of costs as the stages of cost management – overview of literature

The analysis and assessment of costs is the second stage of cost management (Horngren *et al*., 2009). It is preceded by cost planning which should be followed by cost recording as the part of chosen cost account as well as by cost control. The main task of the analysis and assessment is to provide information in regards to the level, structure and changes of production costs in various profiles and systems. The information received constitute a basis for making decisions concerning changes in the cost policy of the enterprise (Groot and Budding, 2004). The main goal of those changes is to improve the operational effectiveness achieved mainly by the reduction of costs and/or optimizing their structure.

In the Polish hard coal mining industry the costs are recorded in the traditional accounting systems in the functional and generic system. The modern cost accounting systems implied by the management accounting are not being used (Kaplan and Anderson, 2004). It is a big disadvantage, as the currently used cost accounting systems do not provide information about the costs of particular processes or objects, thus it prevents the assessment of their effectiveness (Hope and Fraser, 2003). The Polish mining enterprises do not use the method of planning costs either. The process of managing costs is therefore defective, bereft of the planning function and in result, also deprived of the motivational function. Enterprises have no reference point, which could be the base for the assessment of final results in the area of costs (Nourzad, 2002). These disadvantages could remain unnoticed or could be insignificant in the enterprises with a stable level of costs. However, in the mining enterprises, strongly and systematically increasing costs constitute a serious threat for the operational effectiveness (Van Helden, 2005). This is the reason for the need for introducing

radical changes in cost management the cause of which is the analysis conducted in the further part of the paper (Modell, 2010).

## 3 Research methodology

Production cost analysis and assessment was conducted in years 2006-2011 for the whole sector in which there are three big state-owned coal partnerships functioning and two other private mining enterprises (Groot and Budding, 2008). In the research there were statistical methods and cause and effect analysis used. For this purpose there were fixed base and chain dynamics indexes as well as structure ratios adopted.

In the first of the research stages there was the analysis of level and total changes of unit production cost made. The analysis was conducted in the current and fixed prices, comparing the results with the total amount of production in the examined period.
Next, the circumstances of changes in unit production cost were presented in a more detailed way, in the context of generic costs analysis. The further analysis was conducted in the current prices and it concerned:

- identification of structure of coal production cost and average unit production cost of hard coal in the hard coal mining in Poland in a generic approach,
- dynamics analysis of separate groups of generic costs in the hard coal mining in Poland.

Cost analysis in a generic system was conducted with the assumption of the following cost positions:

- payroll with surcharges (including salaries, social insurance and other benefits),
- material and energy consumption,
- amortization,
- foreign services,
- other generic costs (including taxes and fees as well as other costs).

## 4 Data analysis – total and unit costs

Cost dynamics in the hard coal mining is directly linked to the production dynamics. Over the period of 2006-2011 the hard coal production was systematically decreasing (table1) (Karbownik and Turek, 2011).

**Table 1**. Hard coal production in years 2006-2011

| Specification | Years | | |
|---|---|---|---|
| | 2006 | 2007 | 2008 |
| Coal production [million tons] | 100.87 | 93.00 | 88.34 |
| Production dynamics [fixed base = year 2006] | 100.00% | 98.62% | 93.68% |
| Production dynamics [variable base] | 100.00% | 92.20% | 94.99% |
| Specification | Years | | |
| | 2009 | 2010 | 2011 |
| Coal production [million tons] | 76.25 | 76.10 | 75.40 |
| Production dynamics [fixed base = year 2006] | 80.86% | 80.70% | 79.96% |
| Production dynamics [variable base] | 86.31% | 99.80% | 99.08% |

Source: own work based on the data from the Ministry of Economy

The most rapid changes in the production level occurred in years 2007-2009. In 2009 the production was stable at the level of 75-76 million tons, which constituted about 80% of production from 2006. The basic reason for such drastic changes in extraction of

this resource in Poland was the economic deterioration on the world market of hard coal and low competitiveness of Polish coal resulting from high and still rising production cost (Ferguson, 2006). The image of hard coal as an energetic resource was also negatively affected due to the introduction of restrictions regarding carbon dioxide emission by the European Union (Zieliński, 2003).

In the analogical period, the decrease of hard coal production was accompanied by the increase of coal production costs (table2) (Michalak, 2012).

**Table 2.** Total production cost of hard coal in years 2006-2011

| Specification | Years | | |
|---|---|---|---|
| | **2006** | **2007** | **2008** |
| Coal production cost [thousand PLN] | 17 550 722 | 17 477 636 | 19 665 962 |
| Production dynamics [fixed base = year 2006] | 100.00% | 99.58% | 112.05% |
| Production dynamics [variable base] | 100.00% | 99.58% | 112.52% |
| Specification | Years | | |
| | **2009** | **2010** | **2011** |
| Coal production cost [thousand PLN] | 19 994 847 | 19 865 282 | 21 607 669 |
| Production dynamics [fixed base = year 2006] | 113.93% | 113.19% | 123.12% |
| Production dynamics [variable base] | 101.67% | 99.35% | 108.77% |

Source: own work based on the data from the Ministry of Economy

According to the data included in table 2, in spite of the fact that the hard coal production decreased by over 20% in the period of six years, the hard coal production cost rose by over 23%. The highest increment of production cost was noted in 2008. In 2010 coal production cost slightly declined (by 0.65%) in comparison with year 2009 but in 2011 increased (by 8.7%) in comparison with year 2010.
Total cost increase with a decreasing hard coal production results in a high growth of unit production cost of hard coal (table 3).

**Table 3.** Unit production cost of hard coal in a sector in years 2006-2011

| Specification | Years | | |
|---|---|---|---|
| | **2006** | **2007** | **2008** |
| Unit production cost [PLN] | 174.00 | 187.93 | 222.62 |
| Unit cost dynamics [fixed base = year 2006] | 100.00% | 108.01% | 127.94% |
| Unit cost dynamics [variable base] | 100.00% | 108.01% | 118.46% |
| Specification | Years | | |
| | **2009** | **2010** | **2011** |

| Unit production cost [PLN] | 262.23 | 261.04 | 286.57 |
|---|---|---|---|
| Unit cost dynamics [fixed base = year 2006] | 150.71% | 150.02% | 164.70% |
| Unit cost dynamics [variable base] | 117.79% | 99.55% | 109.78% |

Source: own work based on the data from the Ministry of Economy

In the examined period (except for year 2010) it is possible to observe a steady increase of coal unit production cost. The highest dynamics of production cost growth occurred in 2008 and 2009 when the unit production cost was rising by about 18% in comparison with the year before. The high dynamics of production cost rise was stopped in year 2010 when the coal unit production cost decreased by about 0.5% in comparison with the previous year. However, the attention should be paid to the fact that the level of this cost in a previous year was already very high and constituted over 150% of cost from the base year – 2006. In 2011 the coal unit production cost started to increase again by almost 10% when comparing with year 2010 (Jonek-Kowalska, 2011).

The high dynamics of average unit production cost growth is a significant threat for the economic-financial situation of mining enterprises and for the competitiveness of Polish hard coal in the face of other world producers and also of other energetic carriers. When searching for the reason of such disturbing dynamics of production cost, in the first turn one should relate to the inflation rate and the analyzed values should be compared in fixed prices. Next, the analysis should be conducted on the structure of average unit production cost of hard coal.

In order to make the assessment of unit production cost changes in the Polish hard coal mining objective, the costs of the examined period were presented in the fixed prices of year 2011. The results of objectification conducted are included in table 4.

**Table 4.** Inflation rates and unit production cost in the hard coal mining in current and fixed prices from year 2011

| Specification | Years | | |
|---|---|---|---|
| | **2006** | **2007** | **2008** |
| Average yearly inflation (CPI) | 1.01% | 2.48% | 4.16% |
| Growing inflation | 14.50% | 13.35% | 10.61% |
| Average unit production cost of coal in current prices [PLN/t] | 174.00 | 187.93 | 222.62 |
| Average unit production cost of coal in fixed prices from year 2011 [PLN /t] | 207.79 | 222.18 | 256.82 |
| Unit cost change in fixed prices in comparison with the previous year | 100.00% | 106.93% | 115.59% |
| Specification | Years | | |
| | **2009** | **2010** | **2011** |
| Average yearly inflation (CPI) | 3.50% | 2.60% | 4.3% |
| Growing inflation | 6.19% | 2.60% | - |

| | | | |
|---|---|---|---|
| Average unit production cost of coal in current prices [PLN/t] | 262.23 | 261.04 | 286.57 |
| Average unit production cost of coal in fixed prices from year 2011 [PLN /t] | 290.44 | 279.35 | 286.57 |
| Unit cost change in fixed prices in comparison with the previous year | 113.09% | 96.18% | 102.59% |

Source: own work

According to data included in table 4, inflation in years 2008 and 2009 increased significantly in the current prices. It is one of the reasons for intensive rise of this cost. Omitting inflation and expressing the average unit production cost of hard coal in the fixed prices from year 2011, the highest dynamics of this cost may still be observed in years 2008 and 2009. Nevertheless, in the next year, that is 2010, the average unit production cost expressed in the fixed prices decreased for the first time by about 3.8% in the examined period in comparison with the year before. However, it is not a steady tendency because in 2011 the unit production cost of hard coal was increasing again. On the basis on the analysis of unit cost in the current and fixed prices, it may be stated that this cost is systematically growing in time despite the production decrease (Jonek-Kowalska and Turek, 2012).

**5 Data analysis – generic costs**

In table 5 there is a compilation of total generic costs presented in the hard coal mining in years 2006-2011 in a valuable depiction. In table 6 their structure is included.

**Table 5.** Production cost in the hard coal mining in a generic system in years 2006-2011

| Costs [thousand PLN] | Years | | |
|---|---|---|---|
| | 2006 | 2007 | 2008 |
| Payroll with surcharges | 8 481 943 | 8 630 960 | 9 889 622 |
| Materials and energy consumption | 3 485 513 | 3 445 073 | 3 759 059 |
| Amortization | 1 509 408 | 1 488 080 | 1 735 616 |
| Foreign services | 3 247 624 | 3 145 190 | 3 560 004 |
| Other generic costs | 826 234 | 768 333 | 721 661 |
| **Total** | **17 550 722** | **17 477 636** | **19 665 962** |
| Costs [thousand PLN] | Years | | |
| | 2009 | 2010 | 2011 |
| Payroll with surcharges | 10 005 807 | 9 330 025 | 10 762 616 |
| Materials and energy consumption | 3 880 070 | 3 614 761 | 3 979 668 |
| Amortization | 1 713 200 | 1 779 587 | 1 847 458 |
| Foreign services | 3 525 505 | 3 342 309 | 3 723 607 |
| Other generic costs | 870 265 | 1 798 600 | 1 294 320 |
| **Total** | **19 994 847** | **19 865 282** | **21 607 669** |

Source: own work based on the data from the Ministry of Economy

**Table 6.** The structure of production cost in the hard coal mining in a generic system in years 2006-2011

| Costs | Years | | |
|---|---|---|---|
| | 2006 | 2007 | 2008 |
| Payroll with surcharges | 48.33% | 49.38% | 50.29% |
| Materials and energy consumption | 19.86% | 19.71% | 19.11% |
| Amortization | 8.60% | 8.51% | 8.83% |
| Foreign services | 18.50% | 18.00% | 18.10% |
| Other generic costs | 4.71% | 4.40% | 3.67% |
| **Total** | **100.00%** | **100.00%** | **100.00%** |
| Costs | Years | | |
| | 2009 | 2010 | 2011 |
| Payroll with surcharges | 50.04% | 46.97% | 49.81% |
| Materials and energy consumption | 19.41% | 18.20% | 18.42% |
| Amortization | 8.57% | 8.96% | 8.55% |
| Foreign services | 17.63% | 16.82% | 17.23% |
| Other generic costs | 4.35% | 9.05% | 5.99% |
| **Total** | **100.00%** | **100.00%** | **100.00%** |

Source: own work

Additionally, in table 7 there is the value of separate generic costs presented in a unit depiction, in calculation per one ton of extraction.

**Table 7.** Structure of production cost in the hard coal mining a generic system in years 2006-2011

| Costs [PLN] | Years | | |
|---|---|---|---|
| | 2006 | 2007 | 2008 |
| Payroll with surcharges | 84.09 | 92.81 | 111.95 |
| Materials and energy consumption | 34.56 | 37.04 | 42.55 |
| Amortization | 14.96 | 16.00 | 19.65 |
| Foreign services | 32.20 | 33.82 | 40.30 |
| Other generic costs | 8.19 | 8.26 | 8.17 |
| **Total** | **174.00** | **187.93** | **222.62** |
| Costs [thousand PLN] | Years | | |
| | 2009 | 2010 | 2011 |
| Payroll with surcharges | 131.22 | 122.60 | 142.74 |
| Materials and energy consumption | 50.89 | 47.50 | 52.78 |
| Amortization | 22.47 | 23.38 | 24.50 |
| Foreign services | 46.24 | 43.92 | 49.38 |
| Other generic costs | 11.41 | 23.63 | 17.17 |
| **Total** | **262.23** | **261.04** | **286.57** |

Source: own work

The highest value of coal production cost occurred in year 2011 and also in the same year the highest rise in the unit production cost took place. In the structure of this cost in all the analyzed years the highest share belongs to the payroll with surcharges constituting about 50% of total production cost. The cost of payroll with surcharges for social insurance and other benefits in 2006 amounted to about 8 481 million PLN and in the conditions of decreasing production in the sector of hard coal, it was increasing until year 2009 when it reached the value of 10 005 million PLN. In 2010 payroll with surcharges showed a declining tendency for the first time in the examined period and fell to the level of 9 330 million PLN. That year the share of the cost of payroll with surcharges was the lowest in the structure of production cost and equaled 46.97%. However, in the last year of the analysis the value of payroll increased to the highest level in the examined period and amounted to 10 762 million PLN and the share of payroll in the structure of unit production cost increased to almost 50%. The value of payroll in the unit production cost equaled from 84.09 PLN/t in the first year of the analysis to do 142.74 PLN/t in year 2011. In year 2010 the unit cost of payroll with surcharges decreased for the first time in the researched period and amounted to 122.60 PLN/t; nonetheless, in the subsequent year this cost grew again (Zieliński, 2006).

The highest share after payroll in the coal production cost belongs to the material and energy consumption cost and foreign services cost. In the examined period they had a similar value and constituted about 16% to almost 20% of total production cost. The share of these two positions in the structure of production cost was decreasing year by year until 2011 when it slightly grew. The materials and energy cost constitute from 19.86% in 2006 to 18.20% of total production cost in 2010. In 2011 its share equaled 18.42%. The materials and energy consumption cost amounted from 3 485 million PLN in 2006 to 3 979 million PLN in 2011, what after calculating per the unit of production equaled from 34.55 PLN/t in 2006 to 52.78 PLN/t in 2011. However, the foreign services cost decreased its share in the structure of production cost from the level of 18.5% in 2006 to 17.23% in 2011. The foreign services cost amounted to 3 247 million PLN in 2006 to 3 723 million PLN in 2011, what after calculating per 1 ton of coal produced equals from 32.20 PLN/t to 49.38 PLN/t.

Amortization – as the next coal production cost according to the share – constitutes from 8.5% to almost 9% of total cost. The amortization cost increased in the examined period from the level of 1 509 million PLN in 2006 to nearly 1 847 million PLN in 2011, what after calculating per 1 ton of production equals almost 15 PLN/t in 2006 and to 24.5 PLN/t in 2011.

The lowest share in the production cost structure, in the most part of the examined period, belongs to other generic costs which include taxes and fees and other costs. In year 2006 they equaled about 826 million PLN what constituted 4.71% of total production cost. After calculating these cost per ton of coal they amounted to 8.19 PLN/t. In the subsequent years the value of other generic costs remained at a similar level until the year 2010. At that time the value of these costs in the production cost structure increased twice and they constituted over 9% of total production cost but their value grew to the level of almost 1 800 million PLN, what after calculating per 1 unit of production amounted to 23.63 PLN/t. In year 2011 the share of other generic costs in the total cost structure decreased to 6%.

A completion of the structure analysis of generic costs is the identification of changes among the separate cost positions in time. It would allow to answer the question which of these costs influenced the most the increase of unit production cost of hard coal in Poland in the examined period (Ivanova *et al.*, 2007). In tables 8 and 9 there are the percentage changes presented of the separate positions of generic costs in comparison with year 2006 (fixed base) and to the previous year (variable base).

**Table 8.** Changes in total generic costs in the hard coal mining in years 2006-2011 (fixed base=2006)

| Costs | Years | | |
|---|---|---|---|
| | **2006** | **2007** | **2008** |
| Payroll with surcharges | 100.00% | 101.76% | 116.60% |
| Materials and energy consumption | 100.00% | 98.84% | 107.85% |
| Amortization | 100.00% | 98.59% | 114.99% |
| Foreign services | 100.00% | 96.85% | 109.62% |
| Other generic costs | 100.00% | 92.99% | 87.34% |
| **Total** | 100.00% | 99.58% | 112.05% |
| Costs | Years | | |
| | **2009** | **2010** | **2011** |
| Payroll with surcharges | 117.97% | 110.00% | 126.89% |
| Materials and energy consumption | 111.32% | 103.71% | 114.18% |
| Amortization | 113.50% | 117.90% | 122.40% |
| Foreign services | 108.56% | 102.92% | 114.66% |
| Other generic costs | 105.33% | 217.69% | 156.65% |
| **Total** | 113.93% | 113.19% | 123.12% |

Source: own work

**Table 9.** Changes in total generic costs in the hard coal mining in years 2006-2011 (variable base)

| Costs | Years | | |
|---|---|---|---|
| | **2006** | **2007** | **2008** |
| Payroll with surcharges | 100.00% | 101.76% | 114.58% |
| Materials and energy consumption | 100.00% | 98.84% | 109.11% |
| Amortization | 100.00% | 98.59% | 116.63% |
| Foreign services | 100.00% | 96.85% | 113.19% |
| Other generic costs | 100.00% | 92.99% | 93.93% |
| **Total** | 100.00% | 99.58% | 112.52% |
| Costs | Years | | |
| | **2009** | **2010** | **2011** |
| Payroll with surcharges | 101.17% | 93.25% | 115.35% |
| Materials and energy consumption | 103.22% | 93.16% | 110.09% |
| Amortization | 98.71% | 103.88% | 103.81% |
| Foreign services | 99.03% | 94.80% | 111.41% |
| Other generic costs | 120.59% | 206.67% | 71.96% |
| **Total** | 101.67% | 99.35% | 108.77% |

Source: own work

In the examined period the other generic costs were rising the most. However, due to their low share in the total cost structure, it did not have a great impact on the final cost value. The strongest influence on costs increase was caused by the rise of

payroll and materials and energy consumption costs. These are the positions of the highest share in total costs rising dynamically in time. Below there is a detailed analysis presented concerning the changes in generic costs by years.

**6 Analysis of data – the determinants of costs**

In **year 2007** the majority of the positions of costs had the value close to the value from year 2006. The highest increase in costs was noted that year in the position of payroll with surcharges. These costs did rise by 1.76% even despite the decreasing the level of employment in the hard coal mining industry by 3.3% in comparison to year 2006. The growth of the share of payroll with surcharges in the structure of production cost is particularly significant for the unit cost of production because of the highest value of this position in the system of generic costs. Furthermore, the lack of correct relations between the rise of payroll and the increase of working efficiency can be observed. In the systems of payroll used, the efficiency factor has little significance. Apart from the payroll, other costs positions in year 2007 presented the negative dynamics. The costs of raw materials and energy experienced a slight decrease (1.16%). Other positions of generic costs in the analyzed period also decreased their share in the structure of costs of coal production in comparison to year 2006. The share of amortization decreased by 1.4%, the share of foreign services by 4.15% and the share of other generic costs by approximately 7%.

In **year 2008** the highest rise in the unit production cost could be noted and at the same time positive dynamics could be observed in almost all cost positions. The highest rise of costs in comparison to the previous year was noted in the position of amortization as well as payroll with surcharges and foreign services. Payroll increased by almost 15%. The costs of foreign services increased by over 13%. The largest increase in this period was in the area of costs of drilling and mining services as well as renovation services. Other costs of foreign services were characterized by the increase between 10 to 20% (transport, renting of machines and mining equipment, loading stone and methane removal). In the examined period only the costs of coal processing did decrease. In year 2008 in comparison to year 2007 also the amortization costs and the costs of the energy and materials consumption grew, even despite the decreasing the level of hard coal mining production by almost 5%. The only position of costs that decreased was the other generic costs that have no significant influence on the structure of total costs. Therefore, over 12% increase of the unit cost of hard coal mining production was influenced mainly by the increase of amortization, the costs of payroll with surcharges and of foreign services. To a lesser extent it was influenced by the costs of materials and energy consumption, although this influence was still significant.

In **year 2009** the increase in unit cost mining cost of hard coal mining was noted once again, although the dynamics of the rise was significantly weakened (increase by over 1.6% in comparison to the previous year). In the examined period the level of payroll with surcharges rose again. This process was accompanied by a rise of the employment level by 0.7%. The increase of unit cost was also influenced by the rise of costs of energy and materials consumption, the other generic costs as well as taxes and fees.

In **year 2010** there was a stop in the rapid rise of the coal production costs. The share of the most important positions of generic costs i.e. the share of payroll, energy and materials consumed and the share of foreign services in the structure of production costs decreased in comparison to the previous year. In that year other generic costs rose significantly but their value is not significant in the structure of coal production cost (Jonek-Kowalska and Turek, 2011).

In **year 2011** again the increase of costs in the hard coal mining industry can be observed. The total costs rose by 8.77% in comparison to year 2010 and the largest increase (approximately 15%) was achieved by payroll. High (approximately 11%) increase regarded also the position of foreign services. Other generic costs which include the costs of representation and advertising, taxes and fees as well as other basic operational costs in year 2011 decreased by approximately 30% in comparison to the previous year (Oczkowski and Sharma, 2005).

**7 Conclusions**

A significant increase of mining costs in the examined period was caused mainly by the rise of payroll. In the Polish hard coal mining industry the trade unions continuously insist on increases of salaries and oppose reducing the employment level even despite the systematically decreasing mining production. The demands of the trade unions are partly motivated by the worsening geological and mining conditions related to the deepening of mines and to the mining production focus. These circumstances make the unit mining cost rise while the total general effectiveness per one employee is continuously decreasing (Basci *et al.*, 2007). The lack of a motivational system tied to the results of work provides additional complication to the already difficult situation. The rise of total and unit costs in the examined period was also influenced by the increase in prices of materials and energy. The rise in foreign services is caused by the growing scale of works commissioned based on outsourcing to external companies, which should reduce the costs and simplify the structure of basic production processes realized in the enterprise.

The Polish hard coal mining industry is considered to belong to the ten largest producers of hard coal. It has rich and valuable deposits. Under favorable business circumstances Polish mining production may achieve the rise in effectiveness, under the condition that:

1. the rate of the increase of payroll will be limited,
2. there will be a rise in the effectiveness of actions in the area of employment restructuring,
3. pro-effectiveness motivational system will be implemented,
4. cost management will be improved by the implementation of planning and calculating the costs in terms of processes (Lapsley and Wright, 2004),
5. actions aimed at reducing costs in other areas will be intensified.

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# THE IMPACT OF FINANCIAL CRISIS AND INSTITUTIONAL REFORMS DEPLOYED IN RESPONSE TO THE CRISIS ON ECONOMIC GROWTH

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Abstract: Institutional changes made in financial markets in response to the crisis became the intrinsic element of anti-crisis measures, especially so at the stage of preventing excessive risk exposure and identifying potential threats to financial stability. At this point in time it is difficult to say precisely, what the effects (long-term in particular) will be of new institutional solutions and whether they would prove effective in fending off the probability of any future crises. Beyond doubt, the current crisis led to re-evaluation of previous perceptions concerning liberalisation of financial markets by exposing their scale and putting strong emphasis on interdependencies between liberalisation, financial stability and long-term economic growth.

Keywords: financial crisis, anti-crisis measures, financial supervision, institutional reforms, institutional regulations, financial stability, effects of institutional reforms, economic growth.

## 1 Introductory remarks

The time before the crisis covers several decades of deregulation, liberalisation and informal changes in core objectives of financial supervision institutions, which changed from assuring broadly defined security and stability to providing easy access to credit. Simultaneous development of IT technology was another contributing factor stimulating financial markets to grow, intensification of capital flows, popularity of ever-complicated financial operations (to a great extent detached from economic processes taking place in the real economy) and enabling to engineer new financial instruments and market segments. Because supervisory institutions failed to exert control over the situation, the last hope laid in markets' ability to self-regulate. That faith, with regard to financial markets, proved to be nothing but naive.....

A deficient regulatory system played a crucial role in igniting the financial crisis. There are three major issues in that respect: flawed microprudential regulation, narrow framework of the regulatory system and relatively underdeveloped macroprudential regulation.

In the first area, the weakest spots are underestimating the risk carried by non-regulated financial institutions (shadow banking system) for balance sheets of commercial banks, as well as no liquidity regulation, which would primarily focus on institutions financing through stock and markets showing considerable divergence between term structure of assets and liabilities.

As far as the scope of regulatory system is concerned, seemingly the most important factor is the sheer size of non-banking (and thus improperly regulated) financial institutions. Over past several years, they have become systemically important, and their standing had major consequences for the crisis. Owing to the impact of those institutions on global financial system, negative effects of that malpractice were commonly felt. In this context, the words of A. Greenspan from October 2008 are particularly noteworthy: *"I made a mistake in presuming that the self-interests of organisations, specifically banks and others, were such that they were best capable of protecting their own shareholders and their equity in the firms (...). The free market collapsed. I still don't fully understand what happened".* Yet back in 2006 Greenspan claimed that "*Because the markets have become too complex, to react to any human intervention, the most appropriate anti-crisis policy is seemingly the one, which ensures the highest market flexibility - freedom of action to the most important market participants. (...) Regulation, by nature, constrains the market's freedom of action, and it is that freedom to operate efficiently which can restore the market balance".*

The crisis also revealed that the control of systemic risk requires macroprudential elements of regulatory system to be enhanced and the pro-cyclical character of banking regulations must be narrowed if not outright abolished.

So it became clear that changes to the institutional *status quo* are required as well. This conclusion came with market developments undermining the validity of original expectations that economic upturn triggered by wide-scale fiscal packages and unconventional monetary policy measures would be permanent. The doubts, however, that the private sector devoid of stimulus packages would not be able to sustain its growth rate once stimulus packages are removed and thus would fail to restore economic growth sadly begun to be the case. Under conditions of anaemic economic revival, previous expectations that economies on their own record would grow their way out of soaring deficit and debt, proved to be unrealistic.

Had the crisis ground to a halt after it had first materialised, there would have not been so many arguments substantiating institutional reforms. Initial economic upswing led many entities to believe that fears concerning the scope, character and projected aftermath of the crisis were exaggerated to a major extent. The need to implement institutional reforms in order to safeguard the market economy from even more stupendous crises in the future, could have easily gotten in the way of more optimistic outlook, where economies would have reverted to the business as usual. One should bear in mind that despite substantial arguments in favour of said reforms, systemic reforms - due to consequently arising political pressures - are unpopular. From this standpoint, an initial economic revival then slipping back into recession could potentially bring positive long-term consequences.

This paper aims to present institutional changes in financial market which were undertaken in a bid to tackle the crisis and determine their consequences. Square one for this analysis must be the awareness that the institutional framework for financial markets primarily in terms of financial supervision were the underlying impetus fuelling the financial crisis. Then discussed are actions undertaken by supervisory institutions and institutional reforms deployed in the wake of crisis. Potential areas of future institutional changes in financial market have also been covered. Finally some controversies surrounding the impact of undertaken institutional reforms on long-term economic growth have been discussed.

## 2 Institutional reforms of financial supervision made in response to the crisis

Growing number of financial institutions, including non-banks and para-banks, emergence of new financial instruments complex in their nature and detached from real economic processes, commonly abused leveraging, concurrent IT development and globalisation of markets all meant that supervisory bodies were no longer capable of exerting effective control. All the more, because legal changes in the pipeline were pro-liberalisation and aimed to loosen the regulative control instead of tightening it. It was the sheer magnitude of the crisis which exposed the need for financial supervision change. The natural first step was to introduce new requirements and guidelines concerning capital reserve levels and the permissible exposure to risky instruments. The fundamental intention was to improve the financial supervision in a bid to stave off future crises. Also introduced was regulation concerning hedge funds, including the requirement to keep records of trading history past certain predetermined levels. Non-banks[1] came into spotlight,

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[1] Non-banks fill the gaps in financial sector, which are not attractive enough for banks. They normally offer the same services as banks (deposits, loans), but also more risky ones (investment, risk management, investment advisory, trading services, brokerage).

which are regulated in a dissimilar manner to banks (*Treasury Department Outlines Reforms...* 2009).

Institutional reforms made during the crisis were supposed to improve four areas:
a) correct risk assessment,
b) consumer and investor protection,
c) removing loopholes from the system,
d) tightening international collaboration.

Critical in US reform was establishing the Financial Stability Board, which features as members all supervisory institutions and is headed by the Secretary of the Treasury. Institutions with assets exceeding 50 billion dollars have to comply with more rigorous legislations than smaller banks. Furthermore, the list of companies supervised by the Fed in line with "more rigorous" criteria can be extended by the Board adding any number of non-banks. Because majority of those institutions - insurers, investment funds, hedge funds - are not supervised by any federal agency, one could expect that in light of that information the Board would not dismiss Fed's applications to extend its regulatory supervision to new entities. The novel character of this solution lies in empowering Fed to determine itself - through the Board - its competences. Moreover their scope is not constrained by considerations which incentivised introduction of that legislation. For instance, bank solvency is supervised, because deposits are state guaranteed, thus generating *moral hazard* - bank neglects risk monitoring because should it topple over, it would be bailed out by the government. New is applying that legislation to companies, previously not state subsidised to any extent - the fact they could potentially cause turbulence in the markets would be a sufficient reason on its own to supervise them. The Dodd-Frank Act, providing legislation for supervision over non-banks is such a flexible framework that making those decisions is in essence a discretionary matter. The Board can subject any company to ever-rigorous regulation once it concludes that financial hardship, nature, reach, scale, concentration, degree of interdependency, and product portfolio offered by the non-bank could potential harm financial stability. That piece of legislation empowers the Board and essentially the Federal Reserve to supervise any financial institution in the United States. Furthermore, the so called Volcker rule prevents any "bank entity" - i.e. bank, its parent company and all subsidiary companies - from propriety trading i.e. with their own assets, in order to limit the scale of risky trading.

As part of institutional reforms, the Consumer Financial Protection Bureau (CFPB) was established, which is envisaged to supervise the mortgage and financial product markets and protect American savings against unforeseen risk (*Treasury Department Outlines Reforms*…2009).

In the Eurozone it is the ECB which guards financial stability. However, due to strict financial integration within the EU area and independent central banks in EU member states with their own currency, the financial stability within the Eurozone was kept by three Committees sat by representatives of national supervisory bodies. At the European level, financial system monitoring has been within responsibilities of the Economic and Financial Committee. The crisis, however, proved the supervision in its current form to be ineffective and insufficient, consequently leading to establishing new EU supervisory institutions, which are charged with assessing risk and financial stability within the EU on an ongoing basis, and should a need arise, act through adequate guidelines and recommendation to mitigate the risk of repeat crisis.

The European System of Financial Supervisors was established in 2011. Main objective of the system is to assure that legislation concerning the financial sector is implemented without

generating potential threats to the financial stability and keeping the financial system commonly trustworthy. It also protects financial services consumers. The system includes the European Banking Authority, European Insurance and Occupational Pensions Authority, European Securities and Markets Authority and national financial supervision authorities. Also established was the European Systemic Risk Board keeping macroprudential supervision over European financial system. The Board is envisaged to counteract systemic risks threatening financial stability within the EU and keeping those risks in check. Those risks might inherently arise from relationships between financial institutions and the markets, as well as from macroeconomic and structural factors.

New legal framework was also put in place. Some of the new legislation was passed already during the crisis, whilst some of has been analysed and negotiated. A directive was introduced concerning higher guaranteed deposits. Another concerned capital requirements. Also passed was legislation regulating rating agencies aiming to eliminate situations similar to pre-crisis conflicts of interest. Deployed measures aimed to make the financial sector more transparent, better and more effectively supervised, whilst keeping consumers and businesses better protected (*Regulating Financial Services...,* 2010*).* Due to regulatory divergence between member states, both the Board and supervisory institutions set out to strengthen sanctions dished out for failing to comply with current legislation or transposing it. They are also intended to make the breaching party feel the pinch and ensure appropriate sanctioning regimes are in place (*Strengthening sanctions*…, 2010).

As far as emerging markets are concerned, it is fair to say they were considerably less affected by the crisis compared to highly developed countries. There were even opinions that we might witness emerging markets being flooded with capital inflows due to perception they are "safe havens", and investing in assets in those countries would be an expression of "flight to quality". The argument substantiating the "decoupling" hypothesis said that in the aftermath of 90's crises, the most affected countries rose to the challenge and put firewalls in place considerably increasing their resilience to similar events in the future. Responses to the previous crises not only did show as spontaneous microeconomic changes, but also as changes in macroeconomic policy, exchange rate regimes and institutional solutions. Those countries reinforced their macroeconomic foundation and have undertaken numerous regulatory and institutional reforms, mainly concerning the broadly defined financial sector. The contagion effect did make its presence felt later and with less ferocity.

The measures deployed by emerging economies in response to the current crisis were predominantly aimed to stop the economic turbulence from spilling over the entire economy (Kawa, 2011). On one hand anti-crisis measures - a mix of economic policy and institutional changes - used by individual countries were different, but nonetheless some generalisations and classification could be drawn (see *Annual Report*, 2009):
▪ higher liquidity of own currency (extending stimulus action with the central bank, accepting wider range of collateral);
▪ higher liquidity of foreign currency (bilateral and multilateral swap agreements, using forex reserves for bank recapitalisation loans, suspending credit limits in foreign currency for banks);
▪ supporting financial instrument prices (restricting short selling, suspending the mark to market rule[2], troubled asset relief funds);
▪ guaranteeing liabilities and bank recapitalisation (increasing state guaranteed deposits, wider range of deposits eligible for state guarantees, recapitalisation of national banks and other financial institutions, running credit guarantee schemes to support business).

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They do not, however, hold licences from their operations and are neither diligently supervised nor controlled by financial supervision. Hence they make more risky investments, consequently increasing "financial brittleness" and risk of turbulence in financial markets. During stable periods they help to more effectively manage financial resources, but their operations are pro-crisis once the economic climate becomes less sturdy.

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[2] Stock valuation rule based on current value.

As far as Poland is concerned, measures deployed by the Polish Financial Supervision Authority (PFSA) together with National Bank of Poland were supposed to incentivise banks to increase their capital ratios as opposed to paying out dividends. The recommendation "S" was amended (first implemented in 2007), which in its new shape is less beneficial for the banks due to its pro-consumer character. In 2008 on the other hand, recommendation "T" was drafted, which was intended to tighten lending standards in order to avoid any future financial turbulence. Its implementation, however, was postponed. Under crisis circumstances and lower credit availability, it could just add fuel to the fire and exacerbate negative crisis repercussions for financial markets.

Both those recommendations (SII and T) are supposed to be complementary. Recommendation T should above all limit the risk of ill-founded creditworthiness assessments through creating and deploying databases - both internal and external, as well as limit excessive lending, especially to poorer customers. Another important matter is factoring in economic cycles when analysing creditworthiness in order to prevent pro-cyclical credit expansion, which markedly took place in the USA (Recommendation T...., 2010, p. 2-5). Recommendation SII is intended to improve supervision over credit exposure to mortgage backed loans, financing property through receivables from the non-financial sector (Recommendation S...., 2011, p. 2).

Also interesting are new institutional regulations issued by the Basel Committee. Main stipulations dictated by capital adequacy standards (Basel III[3]) include requirement for the bank to hold higher common equity (4.5% compared to previous 2.5%) and raised Tier 1 capital (6% compared to previous 4%) of risk-weighted assets. Unchanged remains required total capital to risk-weighted assets ratio (min. 8%). Proposed has been a so called conservation buffer, i.e. additional common equity to cover the 2.5% of risk-weighted assets. This measure will not have been obligatory, however, banks without that buffer will have to reckon with caps imposed by supervisory institutions on profit sharing and executive bonuses. Furthermore, a so called countercyclical buffer will have been introduced, which is dependent on specific country standing (max. 2.5%). Banks will also have to comply with maximum leverage ratios, which is calculated based nominal as opposed to credit-weighted value of assets. Another recommendation is the liquidity coverage ratio. It requires bank to hold sufficient high-quality liquid assets to cover its total net cash outflows over a month should substantial financial turbulence occur. Higher capital requirements intended by the Board might harm short-term credit availability in the economy and decrease bank performance, however in the long run they should increase stability of the global financial system (Basel III, 2012).

To summarise it is fair to say that measures undertaken by market regulators (those measures varying by intensity) have targeted minimising the risk of future financial turmoil of the same magnitude. The financial crisis has revealed a plethora of mistakes and weaknesses of financial watchdog authorities, but above all it undermined the naive belief in market self-regulation, common sense and responsibility of financial institutions. It triggered the need to deploy far-reaching national aid programmes, involving to greatest extent central banks. It also gave a strong impulse to undertake institutional reforms in financial markets.

At this stage, one could pose a question about projected direction of institutional changes in financial markets, especially in the context of supervisory institutions' evolution. The pro-cyclical behaviour of financial markets is not only the effect of intensified credit lending dictated by banks reacting to changes in creditworthiness of business, but also the consequence of financial institutions' expectations towards projected market standing. The problem is though, those projections might be

affected by interchangeable downturns and upturns. At the end of the day, favourable economic situation could compel banks into thinking it could become nothing but better in the future. This vicious circle might lead to softening criteria for creditworthiness assessment. Any future changes in supervisory systems would have to restrain the banks from such snowballing practices. This type of changes is dubbed dynamic regulation, because in essence they aim to prevent banks from eroding their credit criteria during upturn periods. Institutional solutions will beyond doubt also target to reduce procyclicality through introducing different capital requirements. Banks are then required to maintain appropriate ratios of capital to offset potential losses calculated using 10-day VaR. However, because the scale of losses is contingent on price variance which decreases as the economy goes into full swing, the system of capital requirement has a pro-cyclical impact on credit lending. Those requirements could be modified towards maintaining ratios calculated based on long-term losses (Sławiński 2010, p. 154).

New entrants in discussion about the validity, reach and institutional framework of financial supervision refer to positioning of the watchdog. Tendencies to consolidate creating vast financial conglomerates, ever-stronger links within the banking sector, insurance-linked securities and insurance sectors could play into the hands of proponents advocating for regulation by supervisory institutions. On the other hand an argument has been raised that an integrated financial supervision not necessarily would identify risk better than an industry-specific watchdog. This view has also been substantiated by international solutions (international system of regulation and supervision) which are industry-specific in their nature (Davies and Greek, 2010, p. 72).

The position of financial market watchdog (banking supervision) within the structure of central bank has also been a bone of contention. The sheer diversity of theoretical arguments makes developing a single universal model impossible. There seems to be a consensus as to how accurately define the reach of supervisory institutions, deliver precise intervention rules as well as manage communication and coordination of actions undertaken by supervisory institutions, since these have been identified as elements underpinning effective supervision (Subbarao, 2010, p. 27). One should bear in mind though that the efficacy will have been limited due to financial institutions running one step ahead of supervisory institutions. In effect, probably most of regulation will have been adaptive rather than preceding.

**3 Consequences of institutional reforms concerning financial markets for long-term economic growth**

Regardless of short-term effects following from anti-crisis measures and changes of institutional nature, questions have to be asked about their long-term consequences. First and foremost, some doubts are cast over the impact of crisis on the path of potential GDP. Provided it has taken its toll, how did taken measures and reforms help economies to get back on previous tracks of economic growth. Secondly, taken measures have to be scrutinised whether they are able to repel similar crises in the future through decreasing economy's volatility or on the contrary - whether they introduce nothing but disturbance to current institutional order thus causing new waves of the current crisis or similar downturns somewhere down the line.

Implementing institutional changes, determining admissible liberalisation and developing new solutions to financial supervision over financial markets have become critical issues, even more so since they not only determine output levels, but also influence their long-term growth rate. The impact of crisis on long-term growth is usually analysed from these angles (*Word Economic Outlook...,* 2009, p. 121-123).

- workforce - during crisis employment opportunities become scarce and current employees might find themselves asked to retire early; on the other hand, during difficult times people looking for additional income might look for other jobs;

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[3] Basel III was introduced on 26 July 2010, but it should come to full effect by January 2019.

- employment level - during crises unemployment rises, mainly due to increasing structural unemployment. It is caused by temporarily greater divergence between qualifications and economic demand and potential retraining is a long-term process. Strict labour law can pose further challenge. Highly skilled specialists also find it difficult to change employment.
- investment and capital retention - the scale of investments and capital build up rates decrease, since companies have limited access to credit. Financing is also that much harder to obtain due to low asset prices reflected by business valuations and worse creditworthiness;
- effectiveness and efficiency - relationships found between the two remain ambiguous. On one hand the financial system becomes less effective in financing investments especially as far as high rate of return and high risk projects are concerned (financial institutions are facing away from excessive risk). Effectiveness is also lower due to lower R&D spending. On the other hand, crisis cleanses the economy from worst performers in the marketplace.

Empirical analysis concerning a group of several dozen countries affected by recent crises shows (*The State of Public Finances*, 2009, s. 121-123) that output level drops compared to pre-crisis periods. This stems both from long-term employment decrease and lower utilisation of factors of production. An important factor deciding how deep is that drop is the investment to GDP ratio - the higher was that ratio pre-crisis, the higher were losses caused by the crisis. This is simply put down to the fact investment is the most volatile component of aggregate demand. Past experiences show that anti-crisis measures deployed by both monetary and fiscal authorities with little lag to financial turbulence are able to successfully mitigate output level drop. In the light of IMF's findings, over seven years past the crisis output drops have been noted of 10% compared to projections based on previous trends. Over medium-term the growth rate have used to return to pre-crisis levels and long-term tendencies did not buck the trend very much (for majority of countries that deviation did not exceed +/-2 percentage points compared to pre-crisis).

Figure 1. Fluctuation of growth rate post crisis against pre-crisis trend
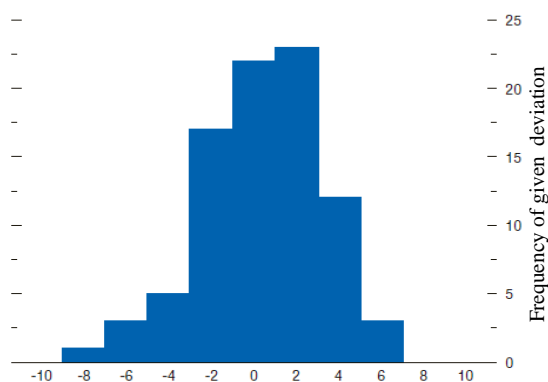


Fluctuation of middle-term[(*)] growth rate against the trend (percentage points)

[(*)] middle-term growth is defined as average 5-year growth rate starting 4 years post the crisis
Source: *World Economic Outlook: Sustaining the Recovery*, MFW, October 2009, p. 127.

When attempting to project consequences of institutional changes for long-term economic growth one should bear in mind that nowadays, ever-increasing emphasis is put on institutional underpinning of growth. Having reviewed current state of arts both theoretical and empirical, Breuer (2005) points to the need to isolate the so-called fourth generation models[4], whose

distinguishing feature is importance pinned down to broadly defined institutions. The author points out variables which to a great extent influence the modelled economic phenomena, namely elements of political system, political instability, social system, ethnic unrest, culture, social standards, corruption, deliverance of contractual obligations, ownership rights and shareholder protection, law sources, financial regulations and supervision etc. In her opinion, those variables are important because they influence information, uncertainty and transactional costs thus the effectiveness of decision making. The author is far from replacing variables found in previous generation models, quite the contrary, she attempts to explore their genesis. Hence, she intends to answer the question "*what institutional factors set the stage for hyperinflation, loss of capital reserves, herd behaviour and political inconsistency*" (Breuer 2005, p. 79).

An interesting element of the Breuer concept is pointing to two opposing effects of a crisis. On one hand, crises intensify uncertainty about all kinds of transaction, relations and decision making, but they also reveal institutional, political and economic weaknesses of economies which all by themselves could cause a crisis. On the other hand, economic slumps can incentivise reforms, which "*could prove beneficial for the economy and limit the risk of repeated crisis in the future*" (Breuer, 2005, p. 2). Drazen and Grill (1993, p. 598) note that *"in the long-term crises increase general prosperity and from that standpoint they are even desirable"*.

The role of institutional factors is also stressed by other authors attempting to generalise experiences of countries developing under conditions of financial crisis. According to Mishkin (2006) key to economic growth is institutional development defined more precisely as tool promoting effective ownership rights and efficient financial system. Abiad and Mody (2005) have taken a different angle on relationship between financial systems and crises. They strive to determine to what extent economic downturns are a trigger for reforms in the financial sector. The nature of that trigger depends on the type of crisis. A balance-of-payments crisis increases probability of reforms, whereas a banking crisis - withdrawal from legislative reforms since if continued, short-term they could hurt valuation of existing banks. This situation looks differently post the crisis. The speed of implementing changes into financial system is among factors critical to length of the recovery period (Mishkin 2006, p. 165).

By referring to the impact severity and strictness of financial supervision over financial markets has on economic growth, Tornell and Westermann (2005) prove that over past two decades, regulatory authorities have addressed overproduction of financial services by liberalisation. Liberalisation of financial markets has been closely followed by a range of financial innovations. Also the number of individual and institutional investors allocating their assets on financial markets has gone up. Novel financial instruments have been used by market participants to hedge against currency risk, turbulences in equity markets and interest rate changes. Furthermore they enabled speculation. There is evidence that currently only approx. 10% of international financial flows are used for purposes of funding commerce and investments, whereas 90% are pure financial

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[4] First generation crises took place between 70s and 80s of the XX century (crises in Mexico, Argentina, Brazil). The underlying cause was ill-founded macroeconomic policy incompatible with fixed exchange rates. Those countries pursed expansive

fiscal policy and the gaping hole in budget deficit was filled by central bank loans. This had led to excessive and uncontrolled inflationary pressures and then difficulties to maintain the currency peg preventing exchange rate from drifting too far from desired rate. Under those circumstances, it became possible to mount a speculative attack with great probability of success. Second generation crises came between 1992 and 1993 to Western Europe (France, United Kingdom) which back then were participating in ERM. The system imposed fixed exchange rate with tight nominal band (± 2.25%). Maintaining the exchange rate within the narrow limits was problematic, consequently creating advantageous conditions for currency speculators, whose pressures were directly the factor behind the crisis. Hence, second generation crises were caused by external factors i.e. a speculative attack. Third generation crises took place between 1997 and 1998 in South-East Asia (Malaysia, Indonesia, Southern Korea, Filipinos). Back then, the macroeconomic situation of those countries was very good - they enjoyed budget surpluses and low inflation, thus the crisis was a major surprise both for investors and rating agencies. Asian crises were caused by malfunction of microeconomic elements i.e. enterprises, especially the banks which took on their balance sheets excessive risk related to bad loans. Those crises, similarly to first generation crises were caused by internal factors.

transactions which to a great extent are of speculative nature (Pilbeam, 2006).

An interesting observation was made, that financial liberalisation often creates interchangeable booms and recessions and that weakness of financial system was, counter intuitively connected to rapid GDP growth. Side effect of that situation is vulnerability of medium-level developed countries' economies to crises. The authors, however, worn against hastily jumping to conclusion that authorities should intervene in financial markets to achieve higher growth rate. They represent the opinion that the very same mechanisms connecting liberalisation with growth enable higher long-term growth rate, but at the same time they introduce strong cyclical fluctuations.

Tornell and Westermann identify two consequences of financial liberalisation: direct effect - positive for growth through lifting restrictions on increasing indebtedness what consequently stimulates economic growth; and indirect effect - negative due to increasing probability of financial crisis erupting. The above-mentioned relationships give a net positive effect of liberalisation on growth. Empirical research conducted by Tornell and Westermann shows that financial liberalisation has positive effect on economic growth rate, but at the same time it significantly increases the probability of financial crisis. Furthermore they prove that positive relationship between liberalisation and economic growth is not caused by countries far from undergoing an economic slump, but those affected by financial downturn. Hence there is a relationship between crises and long-term economic growth. This finding does not mean, however, crises have either positive effect on or generate economic growth (Tornell, Westermann 2005, p. 30).

Another "stylised fact" formed by Tornell and Westermann says that medium-level developed countries implementing financial liberalisation experienced financial deepening where growth rate of indicators concerning financial sector outstripped the GDP growth rate. That process had not avoided turbulence though, and the volatility it underwent was caused to a great extent by weak financial system. Consequently credit availability fluctuated abruptly fuelled by cyclical periods of downturn and upturn. During boom periods credit availability had historically been high, and lenders in tandem with banks accepted high risk exposure.

Tornell and Westermann indicate that shortly before the crisis, banks had loaned on average 3% more compared to periods of "stability". Favourable economic climate had impelled the financial sector to push the leverage beyond reason without putting in place adequate hedging procedures. Deepening crisis generated depreciation reaching as much as 10% even three years down the line. Indebtedness of the banking sector denominated in foreign currencies built up rapidly over prosperity periods, with revenues remaining at unchanged levels. Hence the probability banks would become insolvent increased, causing runs on banks and mass cash withdrawals. Consequently, the economy became unstable and vulnerable to crisis effects. Among factors behind the crisis was also worsening quality of bank assets and build-up of "bad loans". Although the probability of excessive leverage causing crisis any given years was relatively low, accumulation of those effects had eventually upset economic stability. During the credit crunch the value of loans had fallen dramatically[5]. Devoid of liquidity banks were forced to limit credit availability what caused the entire sector to collapse. What is interesting, the drop in loans outstripped the dip in manufacturing output. Moreover, during periods of economic slump the banks pursued policy of

narrowing down the portfolio of financial instruments what intensified consequences of the crisis.

In this context Tornell and Westermann claim another rather surprising "stylised fact", namely that over the past two decades the highest economic growth rate was observed in economies experiencing lending booms and busts. On the other hand the countries where credit availability increased subtlely, saw lower growth figures. Quantitative data explicitly shows that countries where credit growth followed a steeper path (Chile, Korea, Thailand) were subject to cyclic fluctuations, but nonetheless enjoyed stronger growth. On the other hand, countries where credit lending fell only slightly (Bangladesh, Morocco, Pakistan) had weaker economic growth. Hence one could arrive at a conclusion that a "bumpy" credit growth path leads to faster GDP growth. Note, however, that despite wide fluctuations of credit availability are usually correlated with more rapid GDP growth, this combination does not mean that crises - on their own accord - are beneficial for economic growth. The sheer costs of tackling recession and recovering the economy to restore its growth trajectory are tremendous.

Changes in production output during and post crisis are a crucial point in discussion about "stylised facts". Fundamental "fact" here is a v-shaped GDP graph: one of the most surprising observations made about financial crises during the 90s was not the scale of crisis-induced GDP plunge, but the speed at which production output recovered. GDP component deviating the most from pre-crisis levels is investment. Prior to the credit crunch it was as much as 14% higher than over "stability" periods, whereas post crisis its decline exceeded 5%. That significant fluctuations were not observed in case of remaining GDP components: consumption and net exports both pre and post crisis remained unchanged, while government spending did not vary more than ±5% (Tornell and Westermann, 2005, p. 54-55).

Another "stylised fact" is that in the aftermath of financial crisis permanent production decline occurs, because growth rate post-crisis is generally lower than an average growth rate pre-crisis. Unlike recessions part of economic cycles, financial crises are not fluctuations bucking the trend and they are capable of changing that trend (e.g. through mechanisms composing so-called path dependence). Research into financial crises has also proved that long-term production output decline during banking crises outstrips that during monetary crises.

The concept of institutional changes having influence on long-term economic growth has been reflected by the aforementioned theoretical model of crisis mechanisms developed by Tornell and Westerman. Their approach is based on drawing a line between goods contributing to net exports (T) where the dominant force are companies with access to global capital markets and sectors making no contribution (N) where the majority are small enterprises funded by banks. Each of the sectors reacts differently to the shocks, and crucial for widening fluctuations from trend is real exchange rate. Although sector N growth outstrips that of sector T's during boom periods, but at the same time during bust periods it experiences deeper output drops and recovers longer to pre-crisis levels. There are two important institutional differences between the two sectors: N sector enterprises have major difficulties delivering on their contractual obligations (this is particularly visible when liberalisation runs free without legal and institutional reforms) and lenders are underwritten by governments should they go belly up due to the crisis.

The authors built a theory that different groups of countries (moderately developed countries *vs* highly developed countries) react differently to crises. The mechanism behind different reactions is based on asymmetry between sectors in terms of accessible funding, differences in enforcement of contracts and tie up between that market imperfection and state guarantees for enterprises. They explain this mechanism as follows: difficulties with enforcement of contracts combined with state guarantees create severe financial constraints impelling borrowers to

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[5] In moderately developed countries experiencing abrupt changes in economic climate, value of credit loans goes through three phases. During boom times credit lending grows rapidly, when economy slips into recession it slumps considerably and then - as the recovery progresses - it recovers gradually. The graph showing climbing credit usually varies significantly from the trend line. It is characteristic, however, that credit lending in India, country with strictly regulated capital flows, grows showing low average, low standard deviation and asymmetry coefficient close to naught, whereas in Thailand, where liberalisation runs deeply in the system, it shows asymmetric distribution and high standard deviation.

increase their risk exposure (enterprises engage in activities with higher risk profile because should they experience crisis-induced turbulence the government will step in), often in form of currency mismatch (debt in denominated in foreign currency, whereas revenues servicing that debt - in domestic currency). Fluctuations of real exchange rate defined as relative price of T goods compared to N goods intensify the disturbances. This creates circumstances of so-called *risk economy* where credit lending is strong and intense boom and bust periods are probable. Despite being financially brittle and costly to recover from downturns, in the long run this type of economy performs better than *safe economy*. This is possible due to higher risk appetite which enables enterprises with limited access to finance (in majority representing sector N) to borrow and invest more during periods of "normality". Hence future crises would have to be relatively rare, otherwise enterprises would have become risk averse. All in all, the aggregate growth in the N sector caused by higher investments during periods of "normality" is greater than capital losses and shortfall of credit during a crisis. This spills into economy bringing higher average long-term growth across all industries, because T sector enterprises use higher volumes of necessary semi-finished products provided by sector N. The above analysis leads to a simple conclusion that generally in the long run an economy taking on "more risk" is a favourite to achieve higher growth rate (Wojtyna, 2008).

**4 Final remarks**

Long-term institutional reforms implemented as a response to the crisis boil down to assuring stable financial framework and preventing future financial turbulence. Preparing legislative framework, adequate legislation and regulations, developing new and more effective mechanisms is a time-consuming but necessary process. Effectiveness of those measures can only be verified once another crisis is successfully (or not) averted. There is no doubt excessive liberalisation of financial markets played an important role in eruption of the credit crunch. On the other hand though, the subsequent abrupt acceleration of growth rate was fuelled by innovation and ingenious ideas. In the context of Schumpeterian creative destruction one could expect that the crisis - purifying the economy through bringing the weakest companies and institutions to their knees and discontinue least promising projects - could gear the economy for faster long-term growth. In accordance with that approach, excessive regulation of financial sector and restrictions on capital flow could have a negative influence on post-crisis recovery by limiting opportunities for financial innovation, creating new banking and insurance products and reaping benefits from globalisation.

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# COMPETENCE OF DOCTORS IN HOSPITAL MANAGEMENT

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**Abstract:** This publication provides an analysis of the true state of competence of doctors who have been recruited as hospital department managers. The role of ordinator is a position traditionally filled by medical practitioners. In analyzing the competences vested in this group, the author took into account two components, namely knowledge and interpersonal skills. These are traits that can be improved, in terms of both personality and professional skills, however improvement of psychological traits is difficult, since it is economically unprofitable. Experience is gained only in the performance of managerial functions. Medical practitioners who did not hold and did not perform any executive functions in hospitals were analyzed. The author's intention was to examine whether doctors have the characteristics corresponding to the management of medical organizations. For this purpose, the researcher conducted additional research in a group of health care managers with at least 10 years of experience in managerial positions, and education in economics.

Key words: Managerial Knowledge, interpersonal skills, Hospital, Doctor, management professionals, Manager.

## 1 Introduction

In order to identify and detail the components of competence, the author analyzed both Polish and foreign literature, in particular French and English language. A various different definitions of competence are pointed out in literature. However, the most prevalent is a concept according to which is the power of a collection of the following employee characteristics: knowledge of specific subject matter and the ability to use their knowledge and attitudes in an appropriate way for the benefit of the organization[1].

Another approach to ability is illustrated by T. Oleksyn, who believes that it is a combination of knowledge, skills, experience, attitudes and behaviours, and other characteristics important for mental and physical labour, employee willingness to act in the circumstances, and the ability to adapt to change, along with formal features of possibilities for action and decision-making related to work[2]. Professional knowledge is a competence component, the acquisition of which can be improved[3].

Boyatzis R. perceived competence as a set of individual characteristics that belong to such diverse areas as ability, motives, personality traits, abilities and self-image and their social role or a set of acquired knowledge[4].

According to C. Levy-Leboyer[5] competence concerns the integrated utilization of abilities and personality traits, along with acquisition of knowledge and skills, to bring about the successful implementation of a complex mission within an enterprise.

D. Thierry and others cite the powers of general knowledge, experience, attitudes and employee readiness to act in the circumstances. It is also the ability to adapt to changing conditions[6].

K. Symela proposes treating competence as the ability to perform certain professional tasks, the authority to act, decide, express judgments and evaluations necessary for staff to carry out their professional functions and roles in line with agreed performance criteria or standards of product, service or a major decision[7].

An important determinant of desirable characteristics defining the manager is the organization and the external environment. However, a simplified model of a professional manager can be adopted with the following features: communicative, results-oriented, ability to work in a team, leadership skills, planning and organization, business awareness, along with the ability to adapt to the changing environment and stimulate the development of other people, and the ability to solve problems and conflicts and cope with stress[8].

The study was preceded by the creation of an expert panel of researchers and doctor-managers. The group was comprised of three professors, two associate professors, five doctors of the disciplines of management science and psychology, as well as three medical directors with many years professional experience. Thus, an expert panel was created (Delphi method), the members of which, based on their expertise and experience, have developed a set of ranges of managerial knowledge and skills of interpersonal traits, which are useful and desirable as a health care manager. Based on analysis of literature and using the Delphi method, a theoretical model of managerial knowledge and interpersonal skills that are important for optimal functioning in a managerial position was constructed. It is important to note that the basic scope of medical training is based on the acquisition of medical knowledge required to prepare for the provision of medical services, and not to exercise managerial functions.

Managerial expertise is one of the basic elements of a decision support system in an organization. In the case of hospitals, the situation is more complicated than in other companies. This is due to the specific nature of the organization in which representatives of the doctors function, with staff mainly at the medium level of the organizational structure. A not uncommon scene is that of the appointment of a medically qualified person to the position of Managing Director. Of course, the Medical Director position is always a representative of the "white staff."

Of course, some of the interpersonal skills of managers assigned to a position of health care management are also demonstrated when working as doctors. This is particularly evident when dealing with patients, colleagues or superiors. Doctors do not have a great number of opportunities to hone managerial skills because medical studies provide only two items on the issues of sociological and psychological work in the medical profession.

Managerial knowledge can be divided into the following areas: communication with patients, ability to resolve conflicts, communication with superiors or subordinates, ability to deal with stress and difficult situations, ability to negotiate, quality of treatment, communication with colleagues, development of internal hospital relationships (horizontal and vertical), knowledge of legislative changes relating to the health sector, employee management, remuneration system, service processes, including the availability of services and waiting time for service, external image of the hospital, ability to use internal computer programs, settlement with the National Health Fund, ability to bring about change in the organization, employee motivation, knowledge of the principles of mentoring and coaching (partnership relationship between mentors and learners, supporting subordinates for success), control of income and

[1] See: M. Kossowska, I. Sołtysińska, *Szkolenie pracowników, a rozwój organizacji*, Oficyna Ekonomiczna, Kraków 2002, s. 30-35.
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[7] K. Symela (1995) *Standardy programowania treści kształcenia zawodowego* [w:] M. Butkiewicz (red.) Model polskich standardów kwalifikacji zawodowych, Wyd. IteE, Warszawa-Radom, s. 109.
[8] See: T. Oleksyn, *Zarządzanie kompetencjami. Teoria i praktyka*, Wydawnictwo Oficyny Ekonomicznej, Kraków 2006, s. 17-38.

expenditure, time management expectations for the provision of health, supervision of entrusted property (eg, medical equipment), knowledge of workflow procedures, employee evaluation, security of personal data processing, development of training, budgeting, planning of infrastructure investment (in medical equipment or real estate), promotion and dismissal and recruitment.

The author has classified them into 7 groups or areas of expertise: Psychology of management, Change Management, Marketing and Quality, Financial Management, Information Management, Supervision of infrastructure and Human Resources Management. In turn, the field of interpersonal skills includes 14 major characteristics. These are: resistance to stress, responsibility, orderliness, communication, accuracy, constant willingness to learn, openness, empathy, perseverance, creativity, assertiveness, optimism, flexibility and leadership skills.

**2  The employment structure of medical staff**

The vast majority of hospitals are organized in a traditional fashion, based on a vertical management structure, in which there are three levels of management. The main organizational units are based on the division of the organization and can be seen as branches, which may be a hospital department, laboratory or clinic. They are based on the unit's net employment, creating cells of focused professionals with the same or similar qualifications, with putting an ordinator or department manager at their head.

The organizational structure of a typical hospital can be divided into three key groups of employees. First of all administrative staff *(at all levels of management and administration of the hospital)*. Secondly, health professionals, which include: doctors, nurses and midwives *(representing various professions, however, due to the fact that perform a similar function and tasks of the organization, they fall into one professional group)*[9], laboratory diagnosticians, pharmacists, physiotherapists and physical rehabilitation specialists, paramedics and medical technicians and persons practicing other paramedical professions. The third group comprises of technical, support and service staff.

Health professionals, especially doctors and nurses, are most strongly represented in the commercial medical treatment entities (previously non-public health care), where they account for almost 90% of personnel. In the hospitals surveyed, medical representatives account for 50-60% of employment. Through this, their position in the organization is certainly dominant, aided by the fact that in both groups of professional employees, individuals are strongly related to each other by the formation of so-called "mutual support groups" or "interest groups"[10].

The results of the previously discussed problems have a significant effect on the functioning of hospitals. Therefore, in considering promotions, the impact of the representatives of professional groups in the hospital should be taken into account, not only in respect of their size, but also the impact on and creation of the immediate environment. This condition is satisfied by doctors, who, after nurses, are the largest group employed in hospitals, and have the greatest impact on the working environment, as a result of which they enjoy esteem in society.

The positive effect of such relationships is to strengthen the working relationships, increase job satisfaction, a sense of the importance of work and participation in the organization.

Negative results may include antagonized relationships, negative stereotypes being produced as a result of the struggle for divergent interests, the influence of perceived or non-existent relationships, as well as the desire to control different financial issues. In the outlined environment, organizational and relational representatives of a group of medical personnel function in management positions. Thus, every manager of a group within medical and nursing care must show great resources of knowledge and managerial skills in order to organize and manage employees, and for the pursuit of tasks by specific individuals or cells.

**3  Research methodology**

Before conducting any research, regardless of the primary or secondary nature of the source, studies should be conducted on the basis of the available literature and knowledge of the subject in order to build a research hypothesis to be tested. In this paper, the research hypothesis was formulated as follows: *What is the difference between the skills possessed by physicians and health care managers?* The effect of the formulation of such a research question as the main goal was the need to diagnose the cognitive knowledge and interpersonal skills by doctors and managers.

The field of research is determined on this basis. In this case, the level of demand for management of competence. The subject of the study are doctors and managers. Then, the researcher described the research group, for which the research sample was restricted to six hospitals. Each analysis consisted of 20% of employees belonging to the groups of medical and health care managers respectively.In total, the sample was 120 employees from selected locations. A detailed breakdown is shown in Table 1.

Table 1. Size of research groups

| Numer of Hospital | Size of Doctors group | Size of high and medium level of Managers group | Size of research sample | | |
|---|---|---|---|---|---|
| | | | Doctors | Managers | Total |
| Hospital A | 95 | 15 | 19 | 3 | 22 |
| Hospital B | 80 | 12 | 16 | 3 | 18 |
| Hospital C | 77 | 12 | 15 | 2 | 17 |
| Hospital D | 70 | 10 | 14 | 2 | 16 |
| Hospital E | 85 | 13 | 17 | 3 | 20 |
| Hospital F | 74 | 12 | 15 | 2 | 17 |
| Total | 481 | 74 | 106 | 15 | 122 |

*Source: Own work on the basis of empirical research.*

Difficulties in implementing research in hospitals, due to limited access to employees, as well as a notable dislike and distrust of medical personnel in relation to research, required the careful selection of research methods and tools. In order to study indirectly, without the direct participation of the researcher, a questionnaire was selected as the best tool for the purpose, using the survey method[11]. The time range of the medical research covers a period of four months from February to May 2012. However, directors were examined later. This phase of the research was carried out for two months in the same medical establishements from October to November 2012.

Of the 121 surveyed doctors and managers, the questionnaire was returned by 63 physicians and 10 managers. In total, the researcher achieved return of 60.3% for the entire study sample. Among physicians, 59.4% completed the survey, whereas 66.7% of the managers responded positively to the test and returned the questionnaire. The high rate of return from the group of managers was the result of the researcher being known in the hospitals because of a previously conducted research project.

In this section, the researcher checked the correctness of the returned surveys. Due to the simple language and the small number of questions (the questionnaire consisted of two pages), there were no rejected or unsuccessful results. All the surveys

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[9] The same position is represented by the legislation in the Act dated. 15.04.2011 on the therapeutic activity (Dz.U.11.112.654 as amended.) Article 2 paragraph 2 pt. 3 states that for the purposes of the law, a midwife should be understood as a nurse.
[10] See: M. Kęsy, *Diagnoza procesu komunikacyjnego oraz propozycja restrukturyzacji w Hospitalach na podstawie badań własnych* [w:] Kapitał ludzki oraz informatyczne systemy wsparcia w procesie zarządzania przedsiębiorstwem, A. Antonowicz (red.), Wydawnictwo Wydziału Zarządzania Uniwersytetu Gdańskiego, Sopot 2011, s. 144-150.

[11] See: G. A. Churchill, *Badania marketingowe. Podstawy metodologiczne*, Wydawnictwo Naukowe PWN, Warszawa 2002, s. 350-391.

were included in the further analysis. Analysis of the test was preceded by the use of coded results (numeric entry) and their entry into a spreadsheet. Statistical analysis of empirical research was conducted using formulas based on the results.Then, a graphical analysis of the primary data was prepared, as presented in subsequent parts of the publication. The researcher decided against the next steps, involving the validation of the original data by repeating the research to seek inconsistencies and conducting quantitative research. This should be carried out in the form of Delphi qualitative research methods. However, due to organizational and economic impossibility, it was abandoned this stage of research.

**4 State of managerial knowledge of doctors and health care managers**

On the basis of specialized literature and interviews conducted with experienced executives possessing many years of experience, it can be assumed that within managerial knowledge, seven areas of expertise stand out. These consists of: health care finance, marketing, law, accounting, hospital management and employee management.

Table 2 presents data showing the expertise ranges chosen by doctors and mangers. The doctors studied were allowed to choose more than one answer. Among sixty-three subjects, two chose five possible responses, whilst five of the respondents marked four answers. Twelve respondents indicated three areas of knowledge, eighteen chose two answers, and the remaining twenty six people indicated a single answer. Most people chose improved knowledge of staff management and health care marketing. Less frequent were issues of science, and the strictly economic healthcare accounting and finance.

The results obtained from testing 10 health care managers who returned a questionnaire survey, create a picture of a group of people which have very broad interests. On average, 4.7 of those examined had knowledge of management. In the case of doctors, the average was 2.03. It may be deduced that the difference in the improvement of knowledge areas is mainly due to the fact that knowledge of management is in their interests, and is useful for working in this position. Whereas for doctors, who gave a much lower level of response, it is mainly due to the fact that these are side areas which are not associated with their principle job responsibilities.

Table 2. Thematic areas of supplementary managerial knowledge for doctors and managers

| Nature of response | Quantitative structure of doctors | Quantitative structure of managers |
|---|---|---|
| Healthcare Finance | 18 | 9 |
| Marketing | 23 | 6 |
| Law | 21 | 7 |
| Accounting | 17 | 6 |
| Hospital Management | 21 | 10 |
| Human Resources Management | 28 | 9 |
| Total | 128 | 47 |

*Source: Own work on the basis of empirical research.*

The next table shows the self-esteem of doctors, the results of which may not be entirely true, bearing in mind the characteristics of error research methodology. This is due to respondents giving a direct answer relating to the definition of managerial knowledge in those areas which they want to develop. Some people may inflate the results in order to appear better in the eyes of others. However, the research results obtained show for doctors, the self-motivated need for improvement of managerial competence is very low.
It can be concluded, on the basis of prior research, that doctors are largely oriented towards earning and increasing their knowledge of the professional code[12]. They do not have time for other actions and are not interested, therefore the importance of such issues is diminished.

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[12] Reference to earlier studies.

The analysis of the results of management in hospitals perpetuates the image of people who are further developing managerial competence. Of the surveyed managers, 60% stated that they very often and 40% often complement knowledge in the areas listed in Table 1. This is a consequence of their position at work and the obligations resulting from this.

Comparing the results in Table 2 and 3, the conclusion was reached that doctors act to increase managerial expertise as required by law or because they want to obtain a document confirming knowledge. Less often they are actually interested in knowledge for jobs in managerial positions because they do not have the time and/or are more interested in issues possibly useful in their current position.

The need of managers, just as in the case of physicians, to improve their knowledge stems from the fact that it is required by law for its own sake, and this knowledge must be updated. However, it may be supposed that many would not supplement their knowledge so often if they didn't wish to and if it wasn't in their best interests.

Table 3. Degree of self-fulfilment of managerial knowledge by doctors and managers (press)

| Nature of response | Quantitative structure of doctors | Quantitative structure of managers |
|---|---|---|
| Never | 23 | 0 |
| Rarely | 21 | 0 |
| Sometimes | 12 | 0 |
| Often | 7 | 4 |
| Very Often | 0 | 6 |
| Total | 63 | 10 |

*Source: Own work on the basis of empirical research.*

In Table 4, aggregate data was posted concerning managerial knowledge to classify the system from most to least desirable in theory. To sum up the values of all ranges of knowledge within the group the following formula was used:
$\Sigma$ Knowledge level $= ((L_1 \times 1) + (L_1 \times 2) + (L_1 \times 3) + (L_1 \times 4) + (L_1 \times 5)) + ((L_1 \times 1) + (L_2 \times 2) + (L_2 \times 3) + (L_2 \times 4) + (L_2 \times 5)) + \ldots + ((L_N \times 1) + (L_N \times 2) + (L_N \times 3) + (L_N \times 4) + (L_N \times 5))$
where N represents the range of knowledge and $L_N$ is the number of responses indicated; numbers in the range of 1-5 mean self-evaluation of knowledge.

By analyzing information from Table 4, it can be noted that the priority group is the psychology of management theory (PZ). Among the top ten most popular areas of knowledge as many as seven (all) belong to the PZ group. This is followed by the groups Change Management (ZZ), Marketing and Quality (MiJ) and Financial Management (ZF). The smallest number of medical staff reported the need for the range of knowledge that is included in Information Management (ZI), Supervision of Infrastructure (NnI) and Personnel Management (ZK).

Table 4. Supplementary knowledge fields for doctors and managers

| Nature of Response | Doctors | | Managers | | Difference |
|---|---|---|---|---|---|
| | Sum | Score per person | Sum | Score per person | |
| communication with patients | 262 | 4,16 | 4,20 | 42 | 0,04 |
| ability to resolve conflicts | 259 | 4,11 | 4,70 | 47 | 0,59 |
| communication with superiors or subordinates | 257 | 4,08 | 4,80 | 48 | 0,72 |
| ability to deal with stress and difficult situations | 254 | 4,03 | 4,50 | 45 | 0,47 |
| ability to negotiate | 254 | 4,03 | 4,50 | 45 | 0,47 |
| quality of treatment | 252 | 4,00 | 4,40 | 44 | 0,40 |
| communication with | 251 | 3,98 | 4,50 | 45 | 0,52 |

| | | | | | |
|---|---|---|---|---|---|
| colleagues | | | | | |
| development of internal hospital relationships (horizontal and vertical) | 250 | 3,97 | 4,20 | 42 | 0,23 |
| knowledge of legislative changes relating to the health sector | 250 | 3,97 | 4,40 | 44 | 0,43 |
| employee management | 237 | 3,76 | 4,60 | 46 | 0,84 |
| remuneration system | 236 | 3,75 | 4,30 | 43 | 0,55 |
| service processes, including the availability of services and waiting time for service | 236 | 3,75 | 4,30 | 43 | 0,55 |
| external image of the hospital | 235 | 3,73 | 4,30 | 43 | 0,57 |
| ability to use internal computer programs | 233 | 3,70 | 4,20 | 42 | 0,50 |
| settlement with the National Health Fund | 233 | 3,70 | 4,50 | 45 | 0,80 |
| ability to bring about change in the organization | 230 | 3,65 | 4,40 | 44 | 0,75 |
| employee motivation | 227 | 3,60 | 4,40 | 44 | 0,80 |
| knowledge of the principles of mentoring and coaching (partnership relationship between mentors and learners, supporting subordinates for success) | 227 | 3,60 | 4,20 | 42 | 0,60 |
| control of income and expenditure | 226 | 3,59 | 4,10 | 41 | 0,51 |
| time management expectations for the provision of health | 225 | 3,57 | 4,20 | 42 | 0,63 |
| supervision of entrusted property (eg, medical equipment) | 219 | 3,48 | 4,30 | 43 | 0,82 |
| knowledge of workflow procedures | 219 | 3,48 | 4,20 | 42 | 0,72 |
| employee evaluation | 216 | 3,43 | 4,30 | 43 | 0,87 |
| security of personal data processing | 216 | 3,43 | 4,20 | 42 | 0,77 |
| development of training | 213 | 3,38 | 4,30 | 43 | 0,92 |
| budgeting | 213 | 3,38 | 4,20 | 42 | 0,82 |
| planning of infrastructure investment (in medical equipment or real estate) | 209 | 3,32 | 4,40 | 44 | 1,08 |
| promotion and dismissal | 208 | 3,30 | 4,50 | 45 | 1,20 |
| recruitment | 198 | 3,14 | 4,20 | 42 | 1,06 |

*Source: Own work on the basis of empirical research.*

These results show that, according to doctors, the priority is the improvement of managerial knowledge in the field of psychology and educational management. Next, the training should include knowledge of the following areas: Marketing and Quality and Change Management. In the case of other groups, a single range of knowledge, not the whole area of knowledge, was selected. This is due to the preferences of physicians associated with the knowledge they need now, usually resulting from their current professional duties and lack of possibilities to prepare for leadership roles. Therefore, the greatest interest among physicians is soft knowledge, useful in interpersonal relations with superiors, colleagues and patients.

Table 5. The need of doctors and managers for supplementary knowledge in healthcare related fields

| Nature of Response | Doctors | | Managers | | Difference |
|---|---|---|---|---|---|
| | Total | Individual degree of evaluation | Total | Individual degree of evaluation | |
| Psychology of management | 1770/7 | 4,01 | 315/7 | 4,50 | 0,44 |
| Change Management | 961/4 | 3,81 | 175/4 | 4,38 | 0,57 |
| Marketing and | 948/4 | 3,76 | 172/4 | 4,30 | 0,54 |

| | | | | | |
|---|---|---|---|---|---|
| Quality | | | | | |
| Financial Management | 921/4 | 3,65 | 171/4 | 4,28 | 0,63 |
| Information Management | 668/3 | 3,53 | 130/3 | 4,33 | 0,80 |
| Supervision of infrastructure | 428/2 | 3,40 | 87/2 | 4,35 | 0,95 |
| Human Resources Management | 1062/5 | 3,37 | 217/5 | 4,34 | 0,97 |

*Source: Own work on the basis of empirical research.*

**5 Actual interpersonal skills of doctors and health care managers**

Another factor, which according to the author has a significant impact on the proper performance of managers is interpersonal skills, which are much needed in service organizations such as hospitals. The considerations were taken into account in the features that were developed in the framework of the expert panel.

The results obtained have been converted by the researcher according to the following formula. Rating scale ranged from 1 to 5.

$\Sigma$ Interpersonal feature$_N$ = (L$_{WSK}$ x 1) + (L$_{WSK}$ x 2) + (L$_{WSK}$ x 3) + (L$_{WSK}$ x 4) + (L$_{WSK}$ x 5),
where N is any interpersonal trait, L$_{WSK}$ indicates the number of employees, and a number in the range of 1-5 indicates the level of confidence.

Hence, the median was statistically calculated for each of the skills possessed by doctors and health care managers. Of the doctors examined, it was estimated that six characteristics have a very high level, with a further six at a high level, in relation to average scores obtained for the feature of disposition. The lowest scores were for aptitude and self-esteem for doctors acquiring leadership capacity, a feature which has reached not even the average, but instead a low level.

Managers all rated their skills as being at a very high level. The average ratings of all skills in managers was 4.55, whereas in doctors, the result was, on average, lower by 7-8% per skill.

As with the earlier findings, this element of the manager's interpersonal skills can be applied to the medical profession. For three qualities - responsibility, regularity and accuracy, the doctors assessed themselves more highly than health care managers. These are skills that are useful in both aspects of the profession. However, for doctors, these are features that affect the professional duties of their work and organization. In the case of four skills (continuous willingness to learn, openness, empathy and resistance to stress), assessments were at a similarly high level in both groups. Both doctors and managers are forced to continually improve competencies within the competence of the obligations arising from their professional responsibilities. Empathy and openness are qualities that the nature of the work forces upon both types of positions. Resistance to stress is a very useful skill. On the one hand, physicians are responsible for the health of the patient, and bear the burden of being the person upon whose actions the patient's life depends on. On the other hand, managers are accountable to employees, bear the consequences of their actions and, worstly, are in a permanent struggle with financial problems. The next group of six characteristics had a median of the group of medical managers in the range from 0.22 to 0.72. These include: communication skills, perseverance, creativity, assertiveness, flexibility and optimism. According to this test, they are more developed knowledge holders, and the differences are no longer as significant. The author believes that it is precisely this group of features which would improve the skills of doctors. This is due to the fact that doctors have these features (in addition to disposition) at a good level, based on which it would not be difficult to convince the members of this group to participate in their improvement. The final skill is the one feature that is typical for a management position and very useful in the medical

profession. This is the ability of leadership, and the difference is almost 61%. In the group of interpersonal skills, it is the biggest obstacle to deal with for doctors in functional positions. The author proposes improving this feature only when a doctor takes up a healthcare management position.

Table 6. Interpersonal traits held by doctors and health care managers

| Nature of response | Total response | Average rating | Total response | Average rating | Difference |
|---|---|---|---|---|---|
| Responsibility | 289 | 4,59 | 45 | 4,50 | +0,09 |
| Resistance to stress | 288 | 4,57 | 46 | 4,60 | +0,03 |
| Systematic approach | 284 | 4,51 | 43 | 4,30 | +0,21 |
| Accuracy | 283 | 4,49 | 43 | 4,30 | +0,19 |
| Desire to continuously learn | 282 | 4,48 | 45 | 4,5 | -0,02 |
| Communication | 282 | 4,48 | 47 | 4,70 | -0,22 |
| Empathy | 272 | 4,32 | 44 | 4,40 | -0,08 |
| Openess | 270 | 4,29 | 43 | 4,30 | -0,01 |
| Creativity | 268 | 4,25 | 47 | 4,70 | -0,45 |
| Perseverance | 263 | 4,17 | 45 | 4,50 | -0,33 |
| Assertiveness | 259 | 4,11 | 47 | 4,70 | -0,59 |
| Optimism | 257 | 4,08 | 48 | 4,80 | -0,72 |
| Disposition | 242 | 3,84 | 45 | 4,50 | -0,66 |
| Leadership | 184 | 2,92 | 48 | 4,80 | -1,88 |
| Total | 3723 | 4,22 | 636 | 4,54 | |

*Source: Own work on the basis of empirical research.*

These interpersonal skills build a very positive image. The analysis of empirical data shows that doctors have a high level of interpersonal traits. From this, it can be summed up that the doctors have potential in the area of interpersonal skills that predispose them to managerial positions.

**6 Conclusion**

When analyzing the need for knowledge of managerial and interpersonal skills of doctors and health care managers, the specific characteristics and the subjects of most importance and impact on the functioning of the medical organization should be taken into account.

The interpersonal skills of doctors predispose them to perform management functions. Some of these skills can be improved whilst at work in the role of a doctor, because they are useful in everyday working life. On the other hand, other features can be improved when starting work as a health care manager. These features can be enhanced through interpersonal training and conducting case studies.

The situation is different in the field of knowledge management. Representatives of the medical group focused on the acquisition of knowledge useful in accomplishing the operational tasks, the provision of medical services, quality of treatment and patient support. Only some doctors have expertise in financial management and personnel management.

In conclusion, it is difficult to convince medical staff to improve their managerial knowledge unless they have such a need. This research suggests conducting workshops focused on relationship-building skills, internal communication in vertical and horizontal contact with patients, the ability to argue and transparently and comprehensibly to explain the set of diagnoses, as well as dealing with conflict situations and stressors.

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**Primary Paper Section:** A

**Secondary Paper Section:** AE

# SUPPORTING THE DEVELOPMENT OF GERONTECHNOLOGY AS PART OF SILVER ECONOMY BUILDING

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Abstract: The concept of the "silver economy" is one of the complex response trials to the challenges of ageing societies. Its key objective is to bring goods and services to meet the needs of older people through gerontechnology. Article approximates relationships between technology and ageing and the main features of silver economy and gerontechnology. It is supplemented by examples of support efforts to promote gerontechnology including: (1) documents and strategic programs, (2) network organizations and clusters, (3) research and development institutions. Essay draws attention to the development of solutions such as: strategies for innovation, welfare clusters, regional silver economy networks, research institutions such as "agelab" and cultural institutions "medialab". Study indicates directions for further research.

Keywords: ageing policy, silver economy, gerontechnology, robotics divide, welfare clusters, agelab, medialab.

## 1 Introduction

The main purpose of this article is to embed gerontechnology, as a new paradigm of research and implementation, in the context of the "silver economy". It is assumed that this approach allows to reduce the negative impacts of an ageing population through public interventions based on the achievements of scientific and technical progress. Silver economy is an economic system oriented on adjusting the spheres of production and distribution of goods and services to the needs of older people and younger generations that are entering the ageing process. After discussing relationships between technology and the ageing of the population, main features of silver economy and gerontechnology will be described. The next point is analysis of good practices in supporting technologies related to ageing and older people that shows some new organizational and institutional solutions. Article will show selected recommendations for practice and possible areas for further research.

## 2 Technologies and ageing – complex relations

With changes in technology is also associated used nowadays burden (dependency) ratio of working age population by the retirement age population. It is assumed that its growth shows the negative and potential conflict changes in social relations[1]. However at the beginning of the XXI century, scientists are moving away from that "apocalyptic demography"[2]. In fact in developed countries, improving the health of seniors and increasing their awareness and social activity, were observed. Burden ratio has been criticized because it does not take into account the potential of technological innovations, as automation and robotics[3]. These technologies not only allow a longer share of older people in the labor market, but also in partial to labor shortages by increasing the productivity at work and to replace many physical activities – in particular, the tasks identified as "4D": *Dull, Dangerous, Distant* and *Dirty*[4].

In Europe, in the coordination of action against ageing, an important role plays: United Nations Economic Commission for Europe (UNECE) and Organization for Economic Co-operation and Development (OECD). R. Ervik analyzing their concepts – respectively: "society for all ages" and "live longer, work longer" - points out that they ignore the technological innovation and do not

include the potential to solve the problems of ageing populations[5]. These concepts assign too much importance to dependency ratios - these rates are indicative of reforms, but ignore the available technology, and thereby leads to inadequate recommendations and activities of public entities[6].

R. Ervik also argues that one of the challenges in an ageing populations is a phenomenon of "robotics divide". It concerns the unequal access to automation and robotics for countries, regions and local communities, individuals and groups[7]. These divisions may designate a new dimension of social stratification generally referring, not so much to have access to the same technology, as to the facilities offered by it in the performance of activities of daily living. Taking into account changes in technology can contribute not only to a better understanding of the risks from robotics divide, but also to build a more optimistic public policies and future scenarios.

## 3 Silver economy and gerontechnology

In 2007, the European Commission proposed a European Union countries implementing reforms towards building a "silver economy". It was assumed that this is a concept relating to the "combination of good supply conditions (high levels of education, R&D, responsive and flexible markets) and the growing purchasing power of older consumers offers a huge new potential for economic growth"[8]. It is recognized that this is not one sector, but rather a set of products and services from many existing sectors including information technology, telecommunications, financial sector, housing, transport, energy, tourism, culture, infrastructure and local services and long-term care. P. Enste, G. Naegele and V. Leve agree: "silver economy should not be regarded as an own economic sector but rather as a cross-section market, in which numerous industrial sectors are involved"[9]. This phrase is sometimes used alternatively with the term "silver market," which appeared in the early 70s XX century in Japan, with a gradual increase in available facilities for older people. It is a market segment that contains goods, values and services to wealthy individuals over 50., as well as special solutions in trade between economic operators to enable them to adapt to an ageing workforce. Silver market also contains ideas of "universal" and "intergenerational" design. P. Enste, G. Naegele and V. Leve distinguished fourteen silver market segments[10].

The starting point in the creation of strategic programs aimed at the silver economy building should be analysis of the possibility of different production spheres and goods and services distribution. It is important to integrate and stimulate the activity of entities from different sectors, taking into account the characteristics of each country and region. Equaly important

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[1] A. Klimczuk, *Bariery i perspektywy integracji międzypokoleniowej we współczesnej Polsce*, [in:] D. Kałuża, P. Szukalski (eds.), *Jakość życia seniorów w XXI wieku z perspektywy polityki społecznej*, Wyd. Biblioteka, Łódź 2010, p. 92-107.
[2] P. Szukalski, *Zagrożenie czy wyzwanie - proces starzenia się ludności*, „Polityka Społeczna" 9/2006, p. 7-9.
[3] R. Ervik, *A Missing Leg of Ageing Policy Ideas: Dependency Ratios, Technology and International Organizations*, ESPANet, Urbino, 17-19.09.2009, www.espanet-italia.net/conference2009/paper/15%20-%20Ervik.pdf [10.11.2012], p. 6-7, 11-14.
[4] *Ibidem*, p. 9-10.

[5] R. Ervik, *A Missing Leg of Ageing Policy Ideas…*, *op. cit.*, p. 20-21.
[6] *Ibidem*, p. 6-7, 11-14.
[7] *Ibidem*, p. 22.
[8] *Europe's demographic future. Facts and figures on challenges and opportunities*, European Commission, Luxembourg 2007, p. 96.
[9] P. Enste, G. Naegele, V. Leve, *The Discovery and Development of the Silver Market in Germany*, [in:] F. Kohlbacher, C. Herstatt (eds.), *The Silver Market Phenomenon. Business Opportunities in an Era of Demographic Change*, Springer, Heidelberg 2008, p. 330.
[10] Segments of silver market are: (1) IT applications in inpatient and outpatient care; (2) smart living, housing adaptations and supported living services, increasingly on an IT-basis; (3) promotion of independent living, likewise increasingly on an IT-basis; (4) gerontologically relevant areas of the health economy, including medical technology and e-health, hearing and seeing aids technology, dental prosthetics and orthopaedics; (5) education and culture in "response" to higher levels of education and more spare time; (6) IT and media, in particular in conjunction with other market segments such as health, the promotion of independence and security; (7) service robotics, especially in combination with the promotion of independent living in the case of older people with severe health constraints; (8) mobility and the promotion of mobility, e.g. car traffic safety; (9) recreation, travel, culture, communication and entertainment; (10) *Fitness* and *wellness* in response to the higher health awareness particularly of the "younger old"; (11) clothing and fashion to document social integration; (12) services facilitating everyday life and other home services; (13) insurance coverage, especially with regard to age-specific "risks"; (14) financial services "sensitive to demography", especially in the area of capital protection, wealth maintenance and dissaving counselling. See: P. Enste, G. Naegele, V. Leve, *The Discovery and Development…*, *op. cit.*, p. 330-331.

issues are: consideration of the internal diversity of elderly social category; development of marketing to older people; meeting the needs of poorest elderly; empowerment representing the interests of older consumers; products and services development based on dialogue; development of user-friendly design; promotion of consumer rights among the elderly[11]. Particularly important is the coordination of these activities with regard to actions of public sector, commercial and non-government entities in technology transfer field. It is reasonable to take into account four barriers to construction of regional silver economies[12]. It is important to undertake a top-down and bottom-up efforts to build social capital of older people and to adapt infrastructure to the needs of local senior citizens[13].

Gerontechnology is a key element of the silver economy. The author of this term is J. Graafmans[14]. His colleague H. Bouma clarified the definition recognizing that this is a: "study of technology and aging for the improvement of daily functioning of the elderly"[15]. This science has an interdisciplinary approach compatible with the sustainable development and combining research, design, production and marketing. Since the first international congress of gerontechnology in 1991 five directives were recognized: (1) preventing problems; (2) increasing the opportunities for self-dealing with problems without changing the skills and environment; (3) compensating for the loss of the option when facility is not able to supply; (4) providing care only when needed, (5) the study and improvement of existing designs[16]. History of institutional gerontechnology as a science and practice, however, dates back to the 70s XX and research on the basis of ergonomics, gerontology, geriatrics and urbanism[17]. Today it is also linked to environmental and developmental psychology, nursing, medicine, rehabilitation, architecture, and data processing and telecommunications. International Society for Gerontechnology played a key role in popularizing the field in 1997[18].

At the core of gerontechnology lies the knowledge about the biological and psychological human development[19]. Many products, services and spaces no longer perform its function for elderly. These are for example too small buttons, letters, foreign terms, symbols, complex instructions, blurred colors, codes and passwords, bulky architectural barriers. Gerontechnology research cover five main areas: (1) health and dignity; (2) housing and everyday life; (3) mobility and transport; (4) communication and management; (5) work and leisure[20]. There are different dimensions[21] and levels[22] of gerontechnology. In the undertaken

subject meso level is particularly relevant - interactions between organizational divisions in institutions and solutions for dialogue about products and technologies, such as municipal senior councils, associations of public authorities, manufacturers, designers and consumers.

**4 Types of gerontechnology development support**

Based on a review of the literature three main solutions used to support the development of gerontechnology and broader silver economy can be distinguished. These are approaches that can be adapted to the resources, goals, values and needs of the individual entities and regions, taking their cooperation into account. Namely: (1) documents and strategic programs; (2) network organizations and clusters; as well as (3) research and development institutions[23].

**4.1 Documents and strategic programs**

An example might be provided by "Challenges for Building a Future Society - the Role of Science and Technology in an Aging Society with Fewer Children" report by the government of Japan in 2006, which reviewed the scientific tasks for tackling the demographic change. The document discusses the status of research in many disciplines, priorities for further research, the areas of international cooperation and promotion of science[24]. Among others, it brought closer support for technology important in: prevention, diagnosis and treatment of heart disease, cancer, Alzheimer's disease, a regenerative medicine, creating artificial bones and organs, antidepressants, enabling further work and study of the elderly, the development of safety, personalized medical care using cybernetics and robotics.

National Institute on Aging established in the United States in 1974 as a government agency determines the directions of research and prepares scientific staff and collaborates with external entities. Announced in 2007, the plan covers six directions of research: (1) improving knowledge on successful ageing, diseases and disabilities of the elderly; (2) continuation of the activities to prevent disease and disability, opportunities to improve the health and quality of life of older people; (3) prevention and treatment of Alzheimer's disease, dementia and other diseases of the brain; (4) improving knowledge of the effects of ageing on society, information about them; (5) improving opportunities for reducing and eliminating health inequalities among older people; (6) supporting the development of infrastructure and resources for the promotion of research and communicating their results[25]. Institute conducts research and commission grant competitions: external - tasks for universities, hospitals, medical centers and others, as well as internal - conducted at the premises of funders and other government agencies. In 2009, the United States developed the road map of robotics development with particular emphasis on labor replenishment and providing assistance to live in old age[26].

In the European Union in 6 and 7 Framework Programme in 2004-2012 years existed consortium "European Research Area in Ageing" gathering and coordinating research undertaken by thirteen research centers. In cooperation with the European Commission, the consortium developing the exchange of knowledge, led a scholarship program for young scientists, summer schools and a discussion

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[11] *Ibidem*, p. 337-338.
[12] These are: (1) lack of interest of silver economy and a favorable environment to their actions in the economic entities; (2) limiting the silver economy offers to wealthy older people; (3) a negative pattern of seniors consumption lifestyles; (4) too little attraction force of regions for older migrants. See: A. Klimczuk, *Strategic Responses on Population Ageing in Regional Policy*, [in:] Š. Hittmár (ed.), *Theory of Management 4. The Selected Problems for the Development Support of Management Knowledge Base*, EDIS, University of Žilina, Žilina 2011, p. 261-265.
[13] A. Klimczuk, *Kapitał społeczny ludzi starych na przykładzie mieszkańców miasta Białystok*, Wiedza i Edukacja, Lublin 2012, p. 84-94, 257-268.
[14] J. Graafmans, V. Taipale, *Gerontechnology. A sustainable investment in the future*, [in:] J. Graafmans, V. Taipale, N. Charness (eds.), *Gerontechnology. A sustainable investment in the future*, IOS Press, Amsterdam 1998, p. 3.
[15] *Ibidem*, p. 3.
[16] *Ibidem*, p. 5-6.
[17] D.C. Burdick, *Gerontechnology*, [in:] J.E. Birren (ed.), *Encyclopedia of Gerontology: Age, aging, and the aged*, Academic Press, Oxford 2007, p. 629.
[18] *International Society for Gerontechnology*, www.gerontechnology.info [12.11.2012].
[19] D.C. Burdick, *Gerontechnology*, *op. cit.*, p. 625-627.
[20] There are already a number of products and services using gerontechnology including: websites, solutions to perform telework and remote education, telemedicine, detectors, alarms and sensors, medical kits, diet and beauty, clothing, sunglasses and camera equipment to improve hearing and sense of smell, bathroom and kitchen systems, switches lights, windows and doors, flooring slip , handrails, stair lifts, smart homes, sports equipment, solutions that increase driving safety, road signs, elevators with large hubs and reduced handrails, door handles, curbs and benches. See: D.C. Burdick, *Gerontechnology*, *op. cit.*, p. 627-629.
[21] According to B. Rzeczyński there are utilitarian and humanitarian dimensions of gerontechnology. The first covers the offer and implement products and services to overcome the limitations in communication and access to various infrastructure facilities. The second seeks to restore the productivity of senior citizens in the community. Gerontechnology is realized in individual and infrastructural-organizational dimensions. First involves a biotech instruments, assisting and supporting that have to restore or mitigate the effects of lost operability. Second concerns reconstruction of functional location and urban space. See: B. Rzeczyński, *Gerontechnologia w perspektywie urbanistycznej*, [in:] J.T. Kowaleski, A. Rossa

(eds.), *Przyszłość demograficzna Polski,* „Acta Universitatis Lodziensis. Folia Oeconomica" 231, Wyd. UŁ, Łódź 2009, p. 289.
[22] D.C. Burdick indicates the micro- and macro-structural levels of interaction of gerontechnology and its users. At the micro level are important sensory, perceptual, cognitive or motor interactions with assistive technologies and interfaces. While on macro level considerations such as ethical and moral implications of the available information for older people on the Internet and the potential to create more useful devices for computing. See: D.C. Burdick, *Gerontechnology*, *op. cit.*, p. 620-621.
[23] Compare: A. Klimczuk, *Transfer technologii w kształtowaniu srebrnej gospodarki*, [in:] M. Grzybowski (ed.), *Transfer wiedzy w ekonomii i zarządzaniu*, Wyd. Akademii Morskiej w Gdyni, Gdynia 2011, p. 65-70.
[24] *White Paper on Science and Technology 2006. Challenges for Building a Future Society - the Role of Science and Technology in an Aging Society with Fewer Children*, Ministry of Education, Culture, Sports, Science and Technology, Japanese Government, Tokyo 2006.
[25] *Living Long & Well in the 21st Century: Strategic Directions for Research on Aging*, National Institute on Aging, Bethesda 2007.
[26] H.I. Christensen (ed.), *Roadmap for US Robotics. From Internet to Robotics*, Computing Research Association, Washington 2009.

forum, undertook cooperation with national ministries and agencies. The consortium continues under the current in 2012-2020 "European Innovation Partnership on Active and Healthy Ageing"[27]. The other form is developed as "Ambient Assisted Living Joint Programme"[28]. Programme is implemented by an association formed by government scientific agencies from 20 countries of the European Union with Israel, Norway and Switzerland. By 2013 half of the funding program is from European Commission, half from member states. The aim is to provide grants and funding R&D partnerships made up of small and medium-sized enterprises, consumer organizations and academic institutions. Key priorities for support are works on electronics, embedded systems, control and generation of energy, new materials, interfaces and communication, software and computer networks.

**4.2 Network organizations and clusters**

Another example of gerontechnology support is the network organization[29] *SEN@ER - Silver Economy Network of European Regions* established in 2005 on the initiative of Nordrhein-Westfalen government in Germany. Its aim is to create and establish the framework conditions for new products and services aimed at improving the quality of life of older people and thus providing jobs and employment and strengthening the forces of regional economies and their competitiveness. This mission involves collaboration with industrial partners, social and public authorities. Conditions of establishment *SEN@ER* came from the development of "Silver Economy" initiative started in 1999 in Nordrhein-Westfalen[30]. Land that was the first in Germany that attempted to restructure corresponding to the demographic challenge. At first it was expected to stimulate local stakeholders to create services and products aimed at senior citizens. The barrier, however, turned out to be many solutions addressing only to the wealthy seniors. Then decision was made to search for consumers outside the region. In 2003, after organizing a workshop in Brussels for representatives of local governments and non-governmental organizations a network was established which officially exists since 2005. Its key regions are Extremadura (Spain), Limburg and Gelderland (Netherlands), Limousin (France), Mid-East Region (Irlandia) and North West Region (United Kingdom). The network has a joint secretariat responsible for the coordination, integration and documentation of actions, contacts with the European Commission and the Committee of the Regions, the collection of research results related to the silver economy, supporting the organization of thematic conferences, conducting recruitment website and network members. *SEN@ER* cooperates including: identify of actions that require political support, promote silver economy, integration of professional associations and business organizations, the analysis of the EU's financial programs and presenting recommendations and joint political declaration. The works also include five "special interest groups": active employment and entrepreneurship of the elderly, independent living, participation in culture, skill development and regional strategies. *SEN@ER* also runs a database of European Union documents related to silver economy, good practices, system for searching partners to projects, newsletter, workshops, annual conferences and competitions to promote best practices. Among the selected projects of network are: senior entrepreneurial initiative; computer system to coordinate social services for the elderly, system of smart devices for ageing in place; intercultural seniors creativity

academy; initiative for active ageing of migrants and ethnic minorities which live in European Union.

In Nordrhein-Westfalen its headquarters also have created in 1995, German Society of Gerontechnology focused on small and medium enterprises engaged in the creation, development and sale [31]. Organization conducts standardization and certification of friendly seniors products and services. Since 2007, there is a *Innovations Allianz* – network organization of 26 universities in the region to work with businesses and other associations and institutions. In 2009, the network has developed a topics directory of R&D on ageing, which may be subject to commercialization[32].

Other network organizations on the silver economy and gerontechnology are EdeAN, CAST and RooBO. *The European Design for All e-Accessibility Network* (EDeAN) with secretariat in London is established in 2002. It's the network, which brings together 160 organizations focused on developing and promoting services available to all[33]. Founded in 2003 and headquartered in Washington, DC *LeadingAge Center for Aging Services Technologies* (CAST) is a coalition of more than 400 companies, governments, academic institutions and service companies serving the development, evaluation and adaptation of technology to the needs of seniors[34]. While RooBO is a network run by the Robot Laboratory - R&D unit established in 2004 by the Japanese city of Osaka[35]. In 2010, the network brings together 107 companies and 337 members of the various sectors involved in robotics also for seniors. Network runs trade fairs, conferences, demonstrations, experiments, training of personnel and exchange of scientific and business.

A different solution is developed from the mid-90s XX century in Finland called "prosperity clusters," a type of clusters[36] with specializing in the R&D, consultancy and production and service to improve the quality of life and independence of seniors[37]. This initiative is coordinated by National Research and Development Centre for Welfare and Health (STAKES). Within these clusters are for example efforts to reduce barriers in the urban space, creating a system of home care, a system of document circulation between institutions. *Seniorpolis* is a cluster developed since 1999 in the municipality of Ristijärvi involving public entities, non-governmental and commercial-related products and services, caring, construction, tourism, transport and information technology[38]. After conducting preliminary research of cluster concept work on the construction of innovative nursing homes, senior housing and a leisure and cultural institutions were taken. Cluster also contains common brand of products and services. Since 2006, it comprises a consortium and a center of expertise for gerontechnology testing, including smart homes, furniture and equipment for seniors, which are to be export goods of the region.

**4.3 Research and development institutions**

In the world there are at least a dozen R & D centers specializing in the development of gerontechnology. Sentha is a team formed in 1997 in Berlin by six local universities[39]. Its specialties are interdisciplinary studies and projects developed jointly by engineers, technicians, artists, and social scientists. In 1998, Jerusalem was

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[27] *ERA-AGE2*, www.era-age.group.shef.ac.uk [12.11.2012]; *European Innovation Partnership on Active and Healthy Ageing*, http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing [12.11.2012].

[28] *Ambient Assisted Living Joint Programme*, www.aal-europe.eu [12.11.2012].

[29] Network organization is defined here as "a collection of independent organizations operating in a particular industry but also related with others by cooperation bonds". See: A.P. Wiatrak, *Organizacje sieciowe - istota ich działania i zarządzania*, "Współczesne Zarządzanie", 3/2003, p. 8; cited by: T. Dryl, *Organizacja sieciowa*, [in:] M. Czerska, A.A. Szpitter (eds.), *Koncepcje zarządzania. Podręcznik akademicki*, C.H. Beck, Warszawa 2010, p. 251.

[30] *SEN@ER*, www.silvereconomy-europe.org [12.11.2012]; P. Enste, G. Naegele, V. Leve, *The Discovery and Development…*, *op. cit.*, p. 325-339; M. Ferry, V. Novotný, V. Mancusi, T. Gross, J. Bachtler, *Regions for All Ages: The Implications of Demographic Ageing for Regional Policy*, European Policies Research Centre University of Strathclyde, Glasgow 2006, p. 31-33, 80-90; B. Augurzky, U. Neumann, *Economic resources of senior citizens. Regional economic and fiscal effects of promoting the senior citizens economy in North Rhine-Westphalia*, Ministerium für Gesundheit, Soziales, Frauen und Familie des Landes Nordrhein-Westfalen, Bonn 2005.

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[34] *LeadingAge Center for Aging Services Technologies*, www.leadingage.org [12.11.2012].

[35] *Robot Laboratory*, www.robo-labo.jp/english/ [12.11.2012].

[36] Cluster is defined here as: "geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries and associated institutions (eg. universities, standards bodies and industry associations) in particular fields, competing with each other but also cooperating". See: B. Plawgo, M. Klimczuk, M. Citkowski, *Klastry jako potencjał rozwoju - województwo podlaskie*, BFKK, Białystok 2010, p. 9.

[37] Compare: M. Ferry, V. Novotný, V. Mancusi, T. Gross, J. Bachtler, *Regions for All Ages…*, *op. cit.*, p. 25-28, 61-72; M. Castells, P. Himanen, *Społeczeństwo informacyjne i państwo dobrobytu. Model fiński*, Wyd. Krytyki Politycznej, Warszawa 2009, p. 108-111.

[38] *Seniorpolis*, www.seniorpolis.com [12.11.2012].

[39] *Sentha*, www.sentha.udk-berlin.de [12.11.2012].

established *The Israeli Center for Assistive Technology & Aging* (GeronTech) – non-governmental organization dedicated to technological and market research as well as Israeli-American cooperation[40]. Focused more on the use of information technology action leads *Center for Research and Education on Aging and Technology Enhancement* (CREATE) – consortium formed in 1999 by universities in three different regions of the United States [41]., *Technical Research Centre for Dependency Care and Autonomous Living* (CETpD)[42]operates in Spain since 2003. In 2009, in Oakland, the Center for Technology and Aging was founded - a non-governmental organization that promotes its own research and leads gerontechnology grant programs[43].

AgeLab at the Massachusetts Institute of Technology established in 1999 is a particular example. The aim of the center is "invent new ideas and creatively translate technologies into practical solutions that improve people's health and enable them to 'do things' throughout the lifespan"[44]. Interdisciplinary cooperation here concerns the study of health, transport, communication, housing, economic and political innovation, the evolution of jobs, preparing for old age. Analysis on infrastructure, expectations and capacity to implement institutional innovations for seniors. AgeLab offers unique tools and methods of research, description of which is beyond the scope of this article. AgeLab distinguishes the openness and activities for the development of a positive image of gerontechnology. Centre allows domestic and foreign partners to support research and training, conducting joint projects, partnerships, enable access to data collected by the institute and creation of joint consortia. The center has an offer for volunteers, provides information about the results of research for seniors and their families concerning safe driving, preparing for natural disasters, long term care and retirement planning. Laboratory keeps its work, press releases and video media available by using social networking websites and blogs.

## 5 Conclusions

The paper highlights on the: relations of technological change to the process of ageing; discussion on the legitimacy of burden ratio of working age population to retirement age population; phenomenon of "robotics divide"; major segments and characteristics of the silver market and gerontechnology; as well as experiences of different countries in developing them.

New technologies play important role in meeting the challenges of aging populations. Supporting the development of gerontechnology as a key component of silver economy should be considered an important strategic task. It is necessary to take this paradigm into account in shaping the innovative policies as well as tasks for entities included in the technology transfer and commercialization of knowledge systems. In this way, support for gerontechnology may also be regarded as an important instrument of regional development, if a permanent structures for cooperation of bodies representing the public administration, business and nongovernmental organizations (business support and social economy institutions) will be formed. At the same time it is important to emphasize that the silver economy is not just for the elderly, but also for ageing and younger generations and it has the potential to prepare them for old age.

Public entities should be taking at least four actions: (1) further promotion of knowledge about silver economy and gerontechnology concepts, taking into account the internal diversity of older people; (2) the avoidance of discrimination based on age in the design and promotion of gerontechnology and silver economy models; (3) shaping scientific and educational institutions specializing in gerontechnology such as agelab and placing curricula of this discipline to universities; (4) popularization of cultural institutions like medialabs – interdisciplinary, open to public activity, co-managed, building links between business, science and social

activity while taking into account Internet culture and intergenerational relationships – to shape the image of gerontechnology during the intergenerational integration projects.

There are at least four possible directions for further research: (1) research on the consequences of population aging for the system of science and higher education, as well as technology transfer and commercialization of knowledge. Analysis in subjects such as the lengthening of human life and medicalization of old age; (2) assessment of existing national and regional activities for the silver economy; (3) diagnosis of opportunities to create networked organizations, clusters and centers of research and development focused on shaping of the silver economy and gerontechnology. Including regional specialization of those models; (4) research into methods of innovation planning and design in gerontechnology, as well as analysis on silver market marketing instruments.

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**Primary Paper Section:** A

**Secondary Paper Section:** AE, AO, AP

# ASSET-BASED POLICY: A NEW MEASURE TO REDUCE POVERTY AND INEQUALITY IN BALTIC STATES

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Abstract**:** The article seeks to establish whether asset-based policy would be useful in Baltic states. A brief outlook of current social situation in Baltic states is made and the social policy in place is evaluated. Then, a new direction for social policy - Asset-Based Policy is presented. Various asset-based policy models implemented in other countries are overviewed and compared. Taking into consideration identified benefits, inefficiency of current social policy, economic crisis and austere fiscal policy it is stated that the asset-based policy should be implemented in Baltic states

Key words: Assets, asset-based policy, inequality, Baltic states

## Introduction

Current economic research shows that a public well-being depends not only on the amount of personal wealth or disposable incomes but on their distribution (or inequality) as well. Income inequality, high poverty rate prevent development of society and state, have a significant impact on health and education of residents, conditions of housing and delinquency rate. Income inequality and wealth disparity may cause political discontent and lead to severe social disorders.

Income inequality is commonly measured by Gini coefficient, which shows what part of national income is obtained by the wealthiest residents. A Gini coefficient of 0 expresses perfect equality where everyone has an exactly equal income; a Gini coefficient of 1 expresses maximal inequality where one person has all the income. The world's Gini coefficient is 40; Gini index for the US is 47, and it is only 30 for the EU, which has implemented a model of social welfare state. However, huge disparities exist between different EU member states: Gini coefficient varies from 23,8 in Slovenia to 36,1 in Latvia and 36,9 in Lithuania (2010 data from Eurostat).

It should be noted that economies of Baltic states (Baltic states refer to Estonia, Latvia and Lithuania) have grown rapidly in the last decade – which should have ensured a better life for everyone – though changes of Gini coefficient were not significant: a gap between the rich and the poor did not narrow. Thus, it could be stated that Baltic countries, especially Latvia and Lithuania, draw more attention to a rapid growth of GDP and not to the equitable distribution.

Ineffective redistributive policy - which is oriented towards benefits for the poor and not towards development of their capabilities - is one of the reasons of high income inequality in the Baltics. The other reason is that the main livelihood of the Baltic residents comes from work-related incomes (i.e. wages and salaries); therefore they do not take advantage of the growth of their national economies. Only the rich can buy shares, funds and to take advantage of the economic growth of their countries. Thus, one of the measures to reduce poverty and inequality is to reform current social policy, from income support policy to asset-based policy: i.e. to encourage development of one's knowledge, skills and abilities, promote savings, investments and building of assets and to make a possibility for all to become capital owners.

This article seeks to establish whether asset-based policy would be useful in Baltic states. The methods of the research cover a comparative analysis of scientific literature and a statistical computation. The article starts with a brief outlook of current social situation in the Baltic states. Then it presents the concept of the asset-based policy and provides a summary of the asset-based policy models implemented in foreign countries. Later, results of these policy models are discussed. The paper ends in conclusions.

## 1 Income inequality and efficiency of social policy in Baltic states

In 2000-2010 Baltic economies have maintained a rapid growth; incomes grew as well. However not all types of incomes grew at the same pace. As it could be seen in Figure 1 below, in 2000-2010 nominal GDP grew in Estonia by 132%, in Latvia – by 170%, and in Lithuania – by 107%. Average net salary (not adjusted to inflation) grew at the same pace, while stock market – even taking into consideration a deep downturn in 2007-2009 - grew much more: from 294% in Latvia and 310% in Lithuania to 456% in Estonia (the change of stock market indexes OMX Riga, OMX Vilnius and OMX Tallinn in 2000-2010; not adjusted to inflation and paid dividends). Thus, if we imagine that our human capital (i.e. our experience, knowledge, talents etc.) is an asset which gives us work-related incomes, we could say that its value grew 2-3 times in the last decade, while the value of financial assets invested in Baltic stock markets, rose 4-5 times.

Graph 1. Change of nominal GDP, monthly net salary and stock prices in Baltic countries in 2000-2010 (not adjusted to inflation)
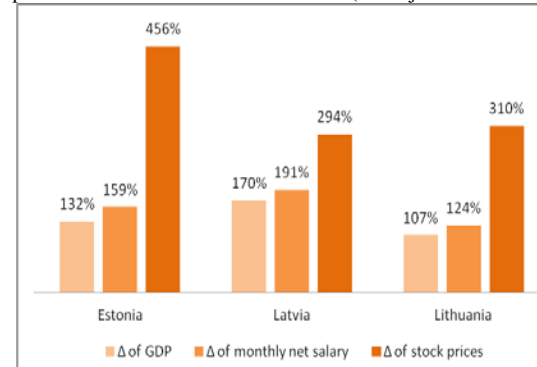


(Source: Statistics Estonia, Central Statistical Bureau of Latvia, Statistics Lithuania and authorial computation)

However, neither rapid economic growth, nor stock market boom have reduced social inequality in the Baltics. In a table below, it could be seen that only Estonia in 2005-2010 decreased its Gini coefficient from 34 to 31, while it remained stable in Latvia and rose in Lithuania. Poverty rate decreased only in Estonia, it remained stable in Lithuania and it rose in Latvia. It should be noted that Gini coefficient and poverty rate of all 12 New Member States converged towards EU average, while in Latvia and Lithuania they remained far from European average.

Table 1. Gini and At-risk-of-poverty rates in Baltic countries

| Country | Gini coefficient (for incomes), % | | | At-risk-of-poverty rate, % | | |
|---|---|---|---|---|---|---|
| | 2005 | 2010 | Δ in p.p. | 2005 | 2010 | Δ in p.p. |
| **EU** | 30,6 | 30,5 | -0,1 | 16,4 | 16,4 | 0,0 |
| **New Member States (12)** | 33,2 | 30,3 | -2,9 | 18,9 | 16,9 | -2,0 |
| | | | | | | |
| **Estonia** | 34,1 | 31,3 | -2,8 | 18,3 | 15,8 | -2,5 |
| **Latvia** | 36,1 | 36,1 | 0,0 | 19,2 | 21,3 | 2,1 |
| **Lithuania** | 36,3 | 36,9 | 0,6 | 20,5 | 20,2 | -0,3 |

Source: Eurostat and authorial calculation

Taking into consideration these indicators, it could be concluded that the social policy in place didn't bring a break-through in a fight against poverty and inequality in Baltic states, especially in Latvia and Lithuania. It should be noted, that different growth rates of different assets (e.g. stock prices vs. work-related

incomes from human capital) and ineffective redistributive policy amplifies social inequality even more.

That is why, in order to reduce inequality, current social policy should be reformed, and the current income support (or income security) policy should be replaced by the asset-based policy which stresses development of capabilities, savings, investments and building of assets.

**2 New direction for social policy**

It should be noted, that traditional methods dealing with poverty and social inequality focus on issues of income and consumption, with particular importance given to the idea of progressive taxation and increase of various benefits to the poor. These actions, called income security or income support policy, have to support individuals when they have insufficient income, face difficulties, whether temporary or constant ones, including unemployment, health problems, accidents or old age. Notably, income security was effective policy measure at the time, when national economy offered a number of stable and long-term jobs, providing regular income to majority of its population. Income security policy however is a passive one: it supports individuals in distress; however, it is not intended to develop their possibilities (Sherraden, 2002, 2003). Besides, income support policy ignores several especially important aspects:

1) various support and benefit programs, aimed at exclusively the poor, strongly reduce the stimuli to work in official labor market, are stigmatizing and are deepening social gap between different social groups more than promoting solidarity;

2) even very progressive taxation cannot ensure proper equality since a considerably larger inequality exists not in the income of individuals but in their accumulated assets. The US research showed that a median white had about 50% higher income than a median African American or Latino, meanwhile, the net assets of a median white was even 1000% (11 times) higher than those of an African American or Latino (Oliver, Shapiro, 2006; Lawerence et al., 2007);

3) transfer of benefits to the poor does not reduce a pre-transfer poverty rate (Danziger, Plotnick, 1986);

4) instead of introducing additional taxes for the rich which would promote evasion and giving new additional benefits to the poor frustrating their initiative, it would be better to give everybody more or less equal starting possibilities.

Modern, post-industrial economy needs active social policy, encouraging personal development and providing motivation for development of one's knowledge, skills and abilities. Latest proposals no longer limit themselves with idea of consumption as a measure of well-being going toward what A. Sen (1993, 1999) identifies as *capabilities*. According to A. Sen, a concept of capabilities is closely related to personal freedom of choice and ability to carry out one's potential to the fullest.

Therefore, despite the fact that income or consumption are still most widely used measure of poverty in social policy, lately efforts were made to develop a vision on combating poverty and social inequality, based on saving, investment and accumulation of asset. Concept, stressing long-term individual possibilities, based on certain asset level, is called *asset-based policy*. (Sherraden, 1991). Notably, asset-based policy does not envisage replacing current income security policy, which is a core idea of a welfare state. Both policies can mutually contribute, seeking their goals: benefits received maintain consumption, while the asset accumulated may encourage personal financial freedom and recovery from poverty. To put it briefly, asset-based policy is one that encourages individuals to save and accumulate asset, to improve, develop one's knowledge, skills and capabilities, thereby contributing to the growth of the national economy and progress of its society (Emmerson, Wakefield, 2001; Loke, Sherraden, 2006, 2008). Therefore, only both policies, based on asset and income, when applied together, can help reaching mutually contradictory goals of fair social policy and high

economic efficiency, thereby cutting the price of trade-off between economic growth and social development.

In the last decade, several countries have focused their social policy in this direction and have started implementing universal asset-based policy. Unfortunately, Baltic states are not on that list, neither are other Central and Eastern Europe (hereinafter CEE) countries.

**3 Asset-based policy: from theory to practice**

Various authors have come up with several different methods to implement asset-based policy:
1) benefits to new-borns: one-time transfers by the government to *child development accounts* opened to all new-borns (hereinafter CDA) (Kelly, Lissauer, 2000);
2) matched savings accounts for the poor and transfers by the government, that match at a certain ratio and to a certain limit the personal savings, transferred to these accounts (Sherraden, 1991);
3) one-time grant to all individuals reaching majority (Nissan, Le Grand, 2000; Ackerman, Alstott, 2005);
4) regular monthly benefits for all citizens of a country, after reaching majority (Van Parijs, 2005).

It should be noted, that these proposals envisage fairly different implementation of asset-based policy, however all of them focus on the same goal, i.e. to accumulate a certain amount of asset, escape from regular cycle of benefits, consumption and poverty, encourage development of personal capabilities and as a result, a better development of entire society and national economy.

Interest in asset-based welfare became increasingly popular throughout the world in the last decade of 20th century. Efforts have shifted from scientific research to practical implementation of ideas:
1) In Great Britain, in 2005 the program of the Child Trust Fund (hereinafter CTF) was introduced which ensured that all children born on or after 1st September 2002 would receive a voucher of 250 pounds (an extra 250 pounds voucher was given for newborns from low-income families) and an additional voucher when reaching 7 years (and possibly 11 years). CTF funds were intended to be invested for a long-term period and managed by parents/legal guardians until a child reached the age of 16. At this point, a child would have an option to take over the management of his account but he would still not be able to withdraw funds from the account until he reached 18. It should be noted, that this program was stopped since 2011 due to the financial crisis.
2) Since 1998 in 40 states of US a program of Individual Development Account (IDA) has been active. It ensures that the savings of low-income families are in a certain ratio (1:1 to 1:3) matched with public funds. In a certain time (usually once in 4-5 years) savings can be used to purchase a first home, to pay post-secondary education, or to start or expand small business.

Other industrialized nations which have more or less developed models of asset-based policy include Canada (CDA), Singapore (coherent program of life-long asset accumulation), South Korea (CDA and savings accounts to the poor) and Hong Kong (CDA). There are pilot programs in Taiwan (savings accounts to the poor) and USA (CDA in Oklahoma; draft legislation for universal CDA policy at national level).

The table below briefly presents key features of these policies.

Table 2. Asset-based policies in selected countries

| Country | Name of accounts / program | Status | Beneficiaries |
|---------|----------------------------|--------|---------------|
| UK | CTF | terminated | children (0-18 years) |
| Canada | RESP (CESG and CLB) | in progress | children (CESG: 0-18 years; CLB: 0-21 years) |
| USA | KIDS | expected | children (0-18 years) |

| Country | Scope | Benefits |
|---------|-------|----------|
| USA | SEED OK | in progress (pilot) | children (0-7 years) |
| USA | IDA | in progress (pilot) | low-income individuals |
| Singapore | Baby Bonus, Edusave, PSEA | in progress | children (Baby Bonus: 0-6 years; Edusave: 6-16 years; PSEA: 7-20 years) |
| South Korea | KCDA | in progress | children (0-18 years) |
| South Korea | Hope Accounts | in progress | low-income individuals |
| Taiwan | TFDA | in progress (pilot) | low-income individuals |
| Hong Kong | CDF | in progress | children (10-16 years) |

Table 2. Asset-based policies in selected countries (contin.)

| Country | Scope | Benefits |
|---------|-------|----------|
| UK | universal | Benefit by the Government at birth and reaching 7 and 11 years |
| Canada | universal | Benefit by the Government to the new-borns from poor families; matching funds for private savings |
| USA | universal | Benefit by the Government at birth; matching funds for private savings (for the poor only) |
| USA | 1360 newborns in Oklahoma, USA | Benefit by the Government at birth; matching funds for private savings (for the poor only) |
| USA | selective; low-income families | Matching funds for private savings |
| Singapore | universal | Benefit by the Government at birth and until the age of 20; matching funds for private savings |
| South Korea | as at the end of 2010, ~41 000 institutionalized children | Matching funds for private savings |
| South Korea | ~13 000 individuals from low-income families in Seoul | Matching funds for private savings |
| Taiwan | selective (not specified) | Matching funds for private savings |
| Hong Kong | Intended for ~13 600 children from low-income families | Matching funds for private savings |

Source: Kim et al., 2010; Han, 2009; Zou, Sherraden, 2010; Sherraden, Stevens, 2010; Sherraden, 2008; Richards, Thyer, 2011 and authorial computation

All these policies are characterized by the fact that there is accumulation of funds in an investment account for a certain period of time (in case an account is opened to a new-born, the funds are mostly accumulated until he/she reaches majority; if an account is opened to a low-income individual, funds are mostly accumulated for 2-4 years), using support of the Government (one-time benefits or matching funds); later on, these funds can be used for a predetermined purpose: mostly for education, housing or starting a small business. Only CTF program that operated in the United Kingdom included no restrictions to the use of accumulated funds.

The first results of saving / investment / asset accumulation programs suggest that the asset-based policy increases individual saving rate, financial literacy and may have positive attitudinal, behavioral, and social effects (Scanlon, Adams, 2009). The most important conclusion is that low-income individuals and families can save, if they participate in saving programs and are provided with information, certain benefits and access to corresponding institutional structures (Mason et al., 2009). How can they accomplish it? The studies have showed that families facing severe financial difficulties can modify their consumption habits and come up with various innovative methods in order to save funds in an investment account of their child (Adams, Whitman, forthcoming).

Besides, it was found out that young people who had even a small stake of private equity at the beginning of their full age, 10

years later would have a large advantage over those who had no equity. This advantage is expressed in lower unemployment level, higher salary and better health. Possession of even a small equity encourages people to invest, save and think about future, and gives them psychological and economic independence (Le Grand, 2010).

Overview of key cases of asset-based policy makes an impression that this policy is tested and implemented in Anglo-Saxon countries and South-East Asia, where the countries have historically inherited or try to imitate the same model of society and social protection (it should be noted, that certain products of asset-based welfare are offered in some other Asian and African countries, however they are provided mostly by commercial institutions, therefore they do not amount to a national policy). This impression is mostly correct: so far, no continental Western European country has carried out similar experiments of asset-based policy (they have a strong welfare state and a well-developed social protection in place); neither has any CEE or Baltic country (these countries traditionally follow their Western neighbors, trying to implement the same welfare state models).

When considering, whether asset-based policy would be necessary in Baltic states, one must keep in mind that these countries are relatively poor, so they will find it hard to create and maintain the costly welfare economy given current economic difficulties and ever more austere fiscal policy conditions. Besides, Greece provides a good example, how the welfare economy over-financed for years discourages efficiency and productiveness and ruins the country.

The new social policy based on the principles of saving, investing and asset building could be a good measure to bring a break-through in a combat against poverty and inequality in the Baltics.

**Conclusions**

1) Neither rapid economic growth, nor stock market boom have reduced poverty and social inequality in the Baltics: inequality and poverty indicators in Latvia and Lithuania remain far from European average.
2) Current income support (or income security) policy is a passive one: it supports individuals in distress; however, it is not intended to develop their capabilities. Thus, it should be replaced by an active social policy, which stresses development of capabilities, savings, investments and building of assets.
3) A concept, stressing long-term capabilities, based on certain asset level, is called *asset-based policy*. During the last decade, several countries started focusing their social policy towards a universal, asset-based policy.
4) The first results of asset accumulation programs suggest that this policy increases individual saving rate, financial literacy and may have positive attitudinal, behavioral, and social effects. Even low-income individuals and families are capable to save.
5) To-date, no continental Western European country has tried to implement asset-based policy; neither have CEE or Baltic countries.
6) Identified benefits of the asset-based policy, high level of poverty and social inequality, economic crisis and austere fiscal policy are the main assumptions to start reforming current social policy in Baltic countries.

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**Primary Paper Section:** A

**Secondary Paper Section:** AH

# THE COMPARATIVE ANALYSIS ON PROBLEM OF MARKETING ACTIONS CLASSIFICATION FOR THE PURPOSE OF TAX LAW IN THE PERSPECTIVE OF EUROPEAN AND POLISH LEGAL SYSTEMS. THE CONTEXT OF SUBSTANTIAL LAW AND LEGAL THEORY.

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Abstract: The primary point of article is to outline some common principles for the European Union Member States in the classification process of the marketing actions as legally eligible incurred income cost and in effect the tax deductible revenue. The paper is written for the purpose of presenting specific aspects of legal theory and the legal text interpretation as useful and effective tools in the process of solving earlier mentioned tax law problems. The article is mostly based on comparative analysis of the European Union Countries tax law as well as provides the classic examples of the classification conflict between representation and advertisement. I addition authors of the article intend to present the entire issue on the example of polish law regulations. The work mainly emphasizes on issues related to the law interpretation and the language logic in the context of analyzing the legal regulations of European tax systems, which could successfully facilitate the process of understanding European Union Countries key legal institutions in the subject matter.

Keywords: taxes, marketing actions, tax deductible revenue, incurred income cost, legal theory, interpretation of law, European tax law, Polish tax law

## 1. The introduction

The instant progress of political and economic integration between European Union Member States causes that the increasing number of entrepreneurs decides to begin conducting business activity in other Member State than their home country[1]. In addition, it cannot be forgotten that the basic aim in expanding business activity to the territories of other member countries is to maximize expected incomes. To achieve this purpose the entrepreneur cannot limit himself only to **increase revenue, but also he should realize that it is necessary to minimize the costs associated with conducted activity at every available field[2].** One of the most important tools, which helps in increasing the income are marketing actions that may be undertaken in various forms. It should be noted that this kind of actions, when performed usually requires the appropriate financial resources. Rational entrepreneur cannot remain indifferent to current legal regulations in the countries, where his or her business activity is conducted. It concerns above all the tax regulations, which creates principles of ranking expenses among obtained tax deductible revenue. At this point it is necessary to mention that international and European Union legislative activity in a notable degree caused standardization of the legal-tax order in European Union Member States. During the process of comparative law analyze, it is possible to derive certain common regularities at general level which could facilitate understanding of the principal system solutions, which are present in every modern country. Naturally it should be mentioned that considering such extensive territories even under the hard top-down imposed conditions of implementing consolidated regulatory standards, the local differences in applying and understanding law will always occur and it is necessary to contemplate such differences individually.

## 2. The definition of tax deductible revenue in perspective of Corporate Income Tax

Tax deductible revenues are the second, after revenue, element affecting the income as economic subject of taxation under the income tax. In the tax law, the concept of obtained income costs functions exclusively in income taxes. In European tax systems it will be British: Personal Income Tax, in German: Einkommensteuer, French: Impôt sur le Revenu des Personnes Physiques, in Poland, paid based on the personal income tax act[3]

(hereinafter referred as the Personal Income Tax Act) and British: Corporate Income Tax, in German: Körperschaftsteuer, French: Impôt sur les Sociétés, in Poland, paid based on the Income Tax Act[4] from legal persons (hereinafter referred as the Corporate Income Tax Act). In most countries, the costs are defined in similar way as in the Polish law[5]. Legal construction of tax deductible revenue is currently one of the most complex regulation types in the field of corporate income tax. The legislative powers of different states usually do not specify all types of tax deductible revenue, which can be deducted from the income during the process of calculating the taxable base. In principle the legislator provides only a general definition supplemented by negative criteria.

If one should better understand the subject matter ought to consider much closer the concept of "costs". From an economic point of view, the cost is a usage of the production factors (raw materials, materials, machines, tools, etc.) and human work in certain closely determined period in the enterprise (company, unit). This usage is expressed in the financial measure[6]. Based on the Polish law, in practice the tax deductible revenue can be both costs of the raw materials consumption, transport costs, expenses on repairs, gas, electricity, rent (lease), expenses related with the office, advertisement and payments of different kinds (e.g. postal, bank), etc. In summary, all expenditure incurred in order to obtain profits will be the tax deductible revenue.

## 3. The eligibility criteria in the classification process of incurred costs as the legal tax deductible revenue

At ranking economical efforts, which were incurred in order to obtain profits, as eligible expenditures that the legislator legally recognized and allows to write off in the given tax year as obtained income costs, there is no consolidated position in tax systems of the European Union Member States. Generally European countries define in similar way the tax deductible revenue. In this field a matter, which is the most variable in the European tax orders is the definition of expenses catalogue, which are legally valid to classify as possible to deduct from the revenue. The main cause of earlier mentioned differences is frequent usage of this legal construction by member states to conduct own socioeconomic policy. In the context of legislative technique, Member States applying the general clause, which specifies what kind of expenditure are suitable to deduct, supplemented by positive enumeration of exact cases, when these given costs classes even if incurred directly in connection with the revenue will not be classified, as the expense eligible to deduction. Additionally, towards every state individually, one should consider the factor of tax law appliance practice (by the administrative authorities and national courts), especially in the form of rich judicial decisions subjecting the earlier mentioned general clause to interpretation. It is also possible that in certain member states, for example in France[7], these authoritative interpretations of the administrative authorities in the tax issues will decides almost entirely, what cost is suitable for a deduction and which is not.

Fundamentally, in every European taxation order the general rule, which has a key role in the classification of economic cost as tax deductible revenue, is a test of causal nexus between the

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[1] See: Hall. S. Scott, *International Finance*, New York 2004 y., p. 148
[2] See: Stephen A. Lind, Stephen Schwarz, Daniel J. Lathrope, Joshua D. Rosenberg, *Fundamentals Of Business Enterprise Taxation*, New York 2002 p. 685 and next.
[3] A bill on Personal Income Tax from 26.07.1991. Dz.U. of 1991 Nr 80, pos. 350, with changes.

[4] A bill on Corporate Income Tax from 15.02.1992. Dz.U. of 1992 Nr 21, pos. 86, with changes.
[5] See: M. Pawlik, *Nowe pojęcie kosztów uzyskania przychodów*,[in:] Monitor Podatkowy 2/2007, p. 13.
[6] See: Jacek Kulicki, *Podatek dochodowy od osób fizycznych 2002 Tom II*, Warsaw 2002 y., p.106.
[7] See: K. Purski[in:] ed. B. Brzeziński, J.P. Tarno, Sądowa kontrola decyzji podatkowych w Republice Francuskiej – podstawowe zasady, Wolters Kluwer business, Warsaw 2011 p. 336 and next.

income and costs incurred for the purposes of paid activity. The income is reduced exclusively by objectively incurred costs (associated with paid activity). Summing up, to legally classify the given cost to the tax deductible revenue group, the costs must be incurred in order to obtain the income. This is a positive criterion. Another factor will be fulfillment of the negative criterion, i.e. the cost which meets a positive criterion, cannot be qualified to the legally not-recognizable group of the economic cost by the legislator for obtained revenue. Therefore, concluded that not all incurred expenses in order to obtain the income or keep the income are eligible to be classified as tax deductible revenue. Polish legislation in this exact field does not deviate from the European standard. Polish regulation of the income taxes, implement the restricted list of expenses, which despite the fact that are incurred in order to obtain the income or to keep or protect the income source, cannot be tax deductible revenue, for instance entertainment expenses or on individual needs of the taxpayer. Detailed list of such expenses presents the Article 16 of the Corporate Income Tax and Article 23 of the Personal Income Tax.

### 4. The costs in legal and economic sense in Polish tax law

Real costs in the economic meaning are one of the elements that shape the legal taxation subject for the purpose of income tax. From this point of view a principle of statutory appointing legal rules, which concerns the costs, guaranteed by the Article 217 of the Polish Constitutions is so essential. It simply does not give to the legislator possibility to delegate the prerogatives in this matter to the executive authority. It is so crucial because without this principle executive power could easily diminish the economic liberties of the individuals. It should be also noticed that the amendments conducted in the legislation in this sphere have vital importance for taxpayers because they creates area of freedom in disposing financial resources as well as have a direct impact on the tax amount[8].

It is necessary to note that statutory definition of the costs differs in a considerable degree from the economic and accounting recognition[9]. Act from 29 September 1994 y. about accounting enables taxpayers, for accounting purposes, to establish the depreciation deduction (amortization) based on sole economic criteria. The period of amortizing fixed assets in this case depends exclusively on economical consumption of this asset. Such kind of write off undoubtedly will be, recognized from the economic and accounting point of view, as the cost associated with conducted activity. In accordance with tax law, to tax deductible revenues shall be ranked only the write off, which will not exceed the amount defined in particular statutes[10]. This is not only one, exclusive tax restriction, for instance among many other restrictions could be listed: leasing rent, business trips, loss in debts, fixed and rotational assets, penalties and sanctions, social insurance contributions. These expenses from the economic or accounting point of view are classified as the costs or extraordinary losses. In addiction it is not possible to rank them, entirely or even in a small part, to the group of tax deductible revenue. These differences between the "cost" in economic or accounting categories and the "cost" in the context of tax law are significant in determining the factual profit and taxable base, so-called the revenue in field of tax law.

### 5. The marketing actions

Not only will the technical classification of particular action to specific legal category have an impact on the costs categorization. But also very important are the factors associated with sole interpretation of terminology, as well as studying the logic or semantic of the characteristic features of concrete names and assigning them a relevant designates. Therefore the indispensable condition of the correct interpretation of tax law

standards is to conduct this process not only based on substantive law and general principles, but also in accordance with strict procedural standards intended for applying the substantive law. In addition, it is necessary to be aware of characteristic features of specific factual situation, which is the subject of interpretation. Generally, all mentioned factors affects possibility to deduct the given costs.

Taking into account previous reasoning, it is possible to start to consider specific issues connected to the marketing actions on the example of advertising and representation. The Christmas season provides excellent examples for this process. Important matter from a practical point of view for companies could be the classification of gifts as tax deductible revenue. Such action may in the significant degree reduce the amount of income tax. On the basis of this example appears a relevant problem for the discussed subject matter. It is simply the difficulty of a finding what kind of actions are advertising and what representation. According to the Article 23 paragraph 1 pt. 23 act of the Personal Income Tax (appropriately Article 16 paragraph 1 pt. 28 act of the Corporate Income Tax), in Polish law the entertainment expenses, in particular for catering services, purchase of food and drinks, including alcohol beverages are not regarded as tax expenditures. Regarding the gift as a representation, even if there will be fulfilled positive criterion (one of two necessary premises which must be fulfilled altogether), the costs will be incurred in order to obtain the income, possibility to deduct will be excluded, because a negative premise will not be fulfilled (the representation is statutory excluded from the group of tax deductible revenue). However, it is possible to deduct the incurred expenditure for activities related with the advertisement.

Unfortunately, in the Polish law, both advertisement and representation are not legally defined in the tax acts. The part of Polish tax law doctrine submits that such definitions should be reconstructed on the basis of different than tax law regulations, which are created to regulate concrete activities like trade of individual things, for instance advertisement of tobacco products[11]. However, the conception of giving specific meaning for terminology, which will be used for purpose of tax law from non-tax regulations, due to tax law special character and its functions as well as constitutional principles of trust to the state and laws or special strict procedures of restricting laws and imposing obligations do not seem to be right[12].

In the opposition to the above, the process of giving meaning to the tax law terminology should be conducted in regard to basic principle of the legal text linguistic interpretation, which constitutes that if in the act, clearly to words was not given a special meaning (e.g. through legal definitions or professional vocabulary) the interpreter must assume that the words has the meaning adequate to colloquial language[13]. Considering practically the term of advertisement, it will be necessary to start with dictionary meaning, where: advertisement [Latin] is, persuasive type of communication, which includes techniques and actions taken in order to draw attention on the product, service or idea; the primary advertisement functions was to provide information about goods and its purchase sources; at present the advertisement fulfills functions of: presentation, shaping the demand, creating and keeping markets; advertisement uses visual sources (publishing companies, newspaper announcements, posters, films, television, neon lights as well as packages, exhibitions, etc.) and audio acoustic (radio, street gigantophones, telephone information service, etc.[14]). Summing up, the aim of advertisement is to inform and encourage to use or to acquire the specific goods as well as

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[8]See: J. Małecki, [in:] A. Gomułowicz, J. Małecki, *Podatki i prawo podatkowe*, Warsaw 2010, p. 652.
[9]See: M. Ślifirczyk, [in:] G. Dźwigała, Z. Huszcz, P. Karwat, R. Krasnodębski, M. Ślifirczyk, F. Świętała, *Ustawa o podatku dochodowym od osób prawnych. Komentarz*, Warsaw 2009, p. 272.
[10] See: Jacek Kulicki, *ibidem.*, p. 105.

[11]See: R. Krasnodębski, *Wydatki marketingowe w świetle ustaw o podatkach dochodowych*, [in:]Monitor Podatkowy 11/2004, p. 20.
[12]See: B.Brzeziński [in:] ed. W. Nykiel, N. Sęk, Protection of Taxpayer's rights – European, International and Domestic Tax Law Perspective, Wolters Kluwer business, Warsaw 2009 p. 21-31.
[13]See:A. Bielska-Brodziak, *Interpretacja tekstu prawnego na podstawie orzecznictwa podatkowego*, Wolters Kluwer business, Warsaw 2009 p.25,60.
[14] See: word: reklama, http://encyklopedia.pwn.pl/haslo.php?id=3966917, 29.11.2010 y.

services. Advertisement takes different forms – starting from reliable information about product features, met mainly in the specialist press, ending at praising the product without reliable technical information about the good, what is often assigned to TV advertising. The Polish Ministry of Finance emphasized that action of advertisement certainly includes activities which are aimed to provide the knowledge about benefits and values of the company, carried out by spreading its logo[15]. At this point it is useful to present official opinion of the Tax Chamber Director in Warsaw, where the authority states that: Company which gives advertising gifts to the customers, can such expenses classify as tax deductible revenues. However, the entrepreneur must establish the causal nexus between incurred expense and obtained income from this specific activity. Additionally, one must remember that an advertisement is action of the business entity, which shapes the demand to given goods, services or brand, by encouraging as many potential customers as it is possible to purchase goods or services[16]. In conclusion it should be noted that an advertisement is the presentation of product in such a manner that it will be attractive for the future customers and has a potential to create the relation between it and the demand for product (the one that will be sold).

At this stage the term of representation should be closer analyzed and during this process emerges the picture of company activity which is aimed on gaining prestige and building positive company image. The Polish Ministry of Finance in the letter from 17th July 1995 y. stated that the term of representation means the grandeur, refinement in someone's lifestyle, associated with the position or social rank[17]. Other opinion states the Supreme Administrative Court (further referred as the NSA) in judgment from 6th May 1998 y. it is stated that: "used term - "the representation"( under the Article 2 paragraph 3 pt. 1 from the statue of Value Added Tax (VAT)) not only has to refer to "grandeurs, refinement", but also refers to "good representing of the company" which includes: appropriate employees clothing, company decor, its logo, billboards, way of entertaining enquirers and contracting parties[18]. In turn, Provincial Administrative Court (further referred as the WSA) in Warsaw in judgment from 21th January 2009 y. emphasized that the term of representation also means taking various actions, which aim to facilitate and support establishing trade relations, also by building personal reports, where one of the main goals is to create entrepreneur image, as the affluent, trustworthy business partner[19]. Prima facie determining what the advertisement is and what is the representation may seem bright and clear, however it is deceptive conclusion. It might seem that these terms are stiff and there is no similarity between them. But looking at their designates and taking into account the multiplicity of different evaluation criteria of these terms, especially in relation to remaining non-linguistic factors, classifying concrete designate to appropriate term does not seem so obvious. To correctly conduct classification process of factual situation to corresponding legal term helpful will be to do abstract analyze of tax law acts and the purposes, that lies beneath the regulation in the context of the situation, which is the subject to this task. In the same moment the factual features of the given activity as well as the factual purpose and main effect of the activity caused in the real world should be considered in the same manner as previously (primarily what is relevant from the point of the tax law). Such specific proceedings could be called as rules of reason that in dubious situations may turn out to be helpful for the purpose of correct classification earlier mentioned terms. From the practical point of view, in unclear situation when ordinary principles of interpretation fails, firstly the purpose of given legal-tax regulation should be recognized, (what the legislator wanted to achieve, the activity which he wanted to tax), secondly very important is to accurately recognize these circumstances in the context of factual event, including the

motives of the taxpayer activities and what significant features his action had, what effect it caused, what was his aim and whether if all this data is relevant from a legal-tax point of view.

Using the above analyses of advertisement and representation terms it is necessary to notice that advertisement as marketing action is used to raise the sales of given goods, so the specific goods are the main matter of advertisement, therefore giving earlier recalled gifts with company logos, as a small sample in order to enable for potential customers option to try out the goods, which in the effect creates the demand for this good, certainly can be categorized as advertisement. While, the representation regards the enterprise as certain functional integrity, thus the entire enterprise is represented and in opposition to that - not the individual product. This kind of action creates the image, renown, recognition, etc. of the enterprise. Analogically, the same action of giving gifts with company logo in the enterprise building, even if that gifts are the products of the company, but it is not aimed mainly on creating demand for this good quite and what more is generally aimed to create corporate image, certainly we will categorized as representation. From other hand, if goods are effectively advertised and indeed meet the customer requirements, also in some way are creating a positive corporate image, (as the producer of the good). But whether these actions consist on representation? It seems that the answer to such question must be negative, because described earlier results (and previously objectives – in the form of building corporate image) are carried out by the way, while the main purpose remains of course completely different.

## 6. The example of conflict on the interpretation field between advertisement and representation

At the beginning of this reasoning we should consider the categorization of occasional company decor e.g. Easter decorations or Santa Claus handing small gifts in the Christmas period. Holiday (Easter or Christmas) atmosphere is supposed to have a stimulating effect on customers and usually encourage them to purchase goods or service offered by the entrepreneur. Whereas it is not hard to recognize Christmas or Easter decorations as an advertisement and not the representation, because representation has generally the features of grandeur and refinement. The problem will appear with hired Santa Claus or Easter Bunny which walks through the shop and encourages for shopping, or gives sweets. At this point the interpreter must find for what purpose and what effect handing these gifts should cause? It is not without meaning what the Bunny has in basket, and Santa Claus in the bag. Concluding from the official statement of Tax Chamber Director in Poznan: "Expenses on advertising gadgets provided with the company logo or product logo (leather wallets, albums, basket gifts and other) up to the amount 100 PLN handed to contracting parties and potential customers may constitute the tax deductible revenue for taxpayer under to the Article 15 paragraph 1 of the Corporate Income Tax, because these are advertising, rather than entertainment expenses"[20]. In the same tone states another Tax Chamber Director in Poznan, the authority confirms that similarly to previous factual situation: "Giving small gifts during parties, exhibitions and similar actions sponsored by the company to potential, current or future customers as well as contracting parties on a large scale (gadgets), provided with the company logo has features of the advertisement, and expenses associated with it can be ranked among tax deductible revenues[21]. However, any shopping vouchers (at the assumption that we aren't acting as e.g. supermarket) about the value of 1000 PLN, handed by the Santa Claus or Bunny without a doubt must be categorized as representation. From the practical point of view, most safe for the taxpayer would be if the gifts will be small, marked with the company and preferably were related with the company activity, then there will be no doubt that the action will be categorized as the advertisement and therefore will be tax deductible revenue.

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[15] See: Biuletyn Skarbowy nb. 5/2007, p.12.
[16] Director of Tax Chamber in Warsaw, IPPB5/423-432/09-6/JC.
[17] Polish Ministry of Finance official statement from 17th July 1995 y. (PO$/AK-722-702/95).
[18] Ruling of Supreme Administrative Court from 6th May 1998 y. (III SA 1452/96).
[19] Ruling of Provincial Administrative Court in Warsaw from 21th January 2009 y. (III SA/Wa 1597/08).

[20] Director of Tax Chamber in Poznań, ILPB3/423-34/09-2a/MC.
[21] Director of Tax Chamber in Poznań, ILPB3/423-192/07-2/MC.

**7. The conclusion**

In the free market economy countries, where the entrepreneurs has to compete every day the marketing actions has key role to play. What more, nowadays it is bigger and bigger trend in the business that the entrepreneurs are building long-term and expensive marketing strategies, which are associated closely to rising financial resources. Therefore the tax regulations are so crucial and essential for every entrepreneur, and are directly connected to the advertisement and representation. Presented knowledge allow to categorize undertaken marketing actions, as advertisements or representation in the meaning of legal term and in turn gives the opportunity to qualify incurred economic costs as tax deductible revenue which simply will be reflected in higher profit.

Summing up, in dubious situations, when other methods seems to be insufficient, it is useful to utilize earlier described rules of reason, that will allow to state about the desired matters e.g. about gifts or holiday decorations character, and in consequence will allow to classify them whether as the representation and not tax deductible revenue or as the advertisement and the tax deductible revenues.

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10. Bielska-Brodziak A.: *Interpretacja tekstu prawnego na podstawie orzecznictwa podatkowego*, Warsaw: Wolters Kluwer business, 2009.25,60 p. ISBN 978-83-7601-475-3
11. Biuletyn Skarbowy nb. 5/2007, p.12.
12. The official Statement of Director of Tax Chamber in Warsaw, IPPB5/423-432/09-6/JC.
13. Polish Ministry of Finance official statement from 17th July 1995 y. (POS/AK-722-702/95).
14. Ruling of Supreme Administrative Court from 6th May 1998 y. (III SA 1452/96).
15. Ruling of Provincial Administrative Court in Warsaw from 21th  January 2009 y. (III SA/Wa 1597/08).
16. The official statement of Director of Tax Chamber in Poznań, ILPB3/423-34/09-2/MC.
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# RECEPTION OF SUPERVISORS' PRESSURE TO ACT UNETHICALLI IN ACCOUNTING

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Abstract: Because financial reporting standards permit enterprises to include judgments in financial reporting, it can also be used to select reporting methods and estimates in order to increase the value of accounting as a form od communication. The article expresses concerns over managements' pressure over accountants to disclose more favorable business economics in financial reporting. It presents findings of a survey held in Poland among accounting practitioners. The survey was aimed to analyze whether Polish accountants face pressure to act unethically in accounting.

Keywords: accounting ethics, accountants, and pressure to act unethically.

## 1 INTRODUCTION

Since the beginning of the twenty-first century one can observe a media tsunami presenting news regarding companies practicing aggressive accounting: AOL, Enron, WordCom, Xerox, Tyco, Rite Aid, Bernard L. Madoff Investments Securieties etc. In Europe, media reported on irregularities in financial reporting of Parmalat (Italy), Lernout & Huspie Speech Products (Belgium), Barclays Bank (United Kingdom), Universal, Swarzedz, and Techmex (Poland). While cases high-lightened in media are different in terms of economic, legal and moral dimension, they all arose from unethical behavior of accountants. Unethical behavior results from individuals' activities; so financial crises observed nowadays are results of behavior of these people. Main reasons of financial crises should therefore be found among humans: their lack of honesty or knowledge. This was evidenced in the first well-known collapse of Enron, during recent financial crises in 2008, and in Polish case of Amber Gold fraud. In many cases accountants are witnessing or participating in unethical behavior in an enterprise. Unethical behavior is one challenge among variety of others during accountants' professional career. Pressure to act unethically might occur in order to fulfill supervisors' expectations concerning amount of incomes, expenses, net profit or tax due. Executives try to make use of multiple choices of accounting law to engage accountants in window dressing of financial statements to gain earnings management goals. English language literature proves that supervisors' pressure to act unethically is the most important dilemma of nowadays accountants.

### 1.1 Literature review

Knowledge of legal requirements is necessary but is not the only sufficient factor affecting the way accountancy services are practiced. Understanding the consequences of choices made during preparation and presentation of financial statements is a very important element of accountancy nowadays. That is why professionalism in accounting falls outside of legal aspects. Responsibility in accounting derives from subordination, and – what's more important – is a guarantee of reliability in accounting as its products affect allocation of scarce economic resources. Lack of awareness about the importance of accounting data results in easy breaking ethical standards of the profession. The situation may be worsening by a pressure of an aggressive policy that accountants experience from their superiors. Researches conducted in the U.S. show that the pressure over unethical behavior is the main reason of ethical dilemmas in accounting.[1]

Ethical dilemmas in accounting were primary noticed in the area of earnings management and were expressed many times in recent years.[2] It was noted that management abuses of "big bath" restructuring charges, premature revenue recognition, "cookie jar" reserves or impairment of intangible assets. Pressure over accountants is being imposed mainly due to capital market motivations like investors' expectations and valuations or contracts signed by management with detailed accounting numbers used to measure financial performance of an enterprise and value management remuneration.

Professor McGee from Barry University in Florida presented survey regarding 13 countries. His findings stress that unethical behavior does not always means illegal activities. There is no distinct boundary between ethical/unethical behavior and legal/illegal actions. The survey findings show that unethical behavior of accountants might be justified by individuals' judgment regarding fairness of a tax system. Aggressive tax and accounting policy very often means illegal action with low probability of discovering the crime and punishment. It makes accountants justify their unethical behavior and it makes it easier to commit fraud more than once.[3] Also Steven E. Kaplan made a research proving that there are different kinds of earnings management in terms of ethical behavior.[4] He showed that employee's position in the organization influence his/her moral judgment regarding earnings management and that it is not possible to create a list of unethical behaviors among accountants concerning earnings management. Lack of a list with well-described unethical behaviors requires accountants to be aware of any possibility of legal but unethical action of management.

Different goals of accounting system and management incentives are well presented in the agency theory widely used in economy.[5] Theory presents behavior of two players with conflicting goals. Players might be manager and accountant as their goals are different: accountant is obliged to present true and fair view of financial position of an enterprise, while manager is supposed to fulfill his duties regarding minimum return on invested capital or net profit of a business. The theory stresses that each player has different information, which means that accountant might not know why superior makes pressure to a certain earnings management activities or tax avoidance practices. On the other hand, an accountant being hired by a manager is in unfavorable position of a subordinate. Each player is interested in obtaining his/her goals using rational instruments. That is why a justification to act unethically in accounting derives from persons' attitude regarding pressure and superiors' expectations about his/her behavior. Researchers suggest that as long as there is a social permission to act unethically and no legal punishment exists, unethical behavior in accounting will occur with low chance of disclosing it.[6]

## 2 SURVEY DESCRIPTION

In Poland, a research aiming to analyze managements' pressure to act unethically in accounting was not made yet. The survey conducted by the author consisted of 29 statements. Four of them indicated supervisors' pressure and these were the subject of that article. Using a seven-point Likert scale, respondents

[1] Finn, D., Chonko, L. and Hunt, S.: *Ethical Problems in Public Accounting: The View from the Top.* „Journal of Business Ethics" 1988, Vol. 7, pp. 605–615. Cruz, Ch. A., Shafer, W. E., Strawser, J. R.: *A Multidimensional Analysis of Tax Practitioners' Ethical Judgements.* "Journal of Business Ethics" 2000, Vol. 24, pp. 223-244. Donaldson, T., Dunfee, T.W.: *Toward a Unified Conception of Business Ethics: Integrative Social Contracts Theory.* „The Academy of Management Review" 1994, Vol. 2, pp. 252-284.

[2] Healy, P.M., Wahlen, J.M.: *A Review of the Earnings Management Literature and its Implications for Standard Setting.* „Accounting Horizons" 1999, Vol. 13, pp. 365-383. Indjejikian, R., Matejka, M.: *CFO Fiduciary Responsibilities and Annul Bonus Incentives.* "Journal of Accounting Research" 2009, Vol. 47, pp. 1061 – 1093.
[3] McGee, R.W., Tyler, M.: *Tax Evasion and Ethics: A Demographic Study of 33 Countries.* "Andreas School of Business Working Paper" 2006, Barry University, Unied States of America.
[4] Kaplan, S.E. *Ethically Related Judgments by Observers of Earning Management.* "Journal of Business Ethics" 2001, Vol. 32, pp. 285 – 298.
[5] von Neumann, J., Morgenstern, O.: *Theory of Games and Economic Behavior.* Princeton University Press 1953.
[6] Gibson, A.M., Frakes, A.H.: *Truth or Consequences: A Study of Critical Issues and Decision Making in Accounting.* „Journal of Business Ethics" 1997, Vol. 16, pp. 161-171.

were asked to indicate the appropriate number showing their agreement or disagreement with each statement. A score of zero (0) represented strong disagreement with the statement, while a score of seven (7) represented strong agreement. The survey was held among public and private university students. Participation in the survey was voluntary and no remuneration was offered. Over tree hundred questionnaires were collected. Although the survey was made among accounting faculty working and non-working students only, less than 30% of respondents were accounting practitioners, and only 1 out of 87 questioned students were male student.

The following hypotheses were made:
1) A supervisors' pressure exists among accountants practitioners in Poland.
2) Accountants do need the knowledge how to fight that pressure in order to maintain high quality of professionalism.

**2.1 Survey findings**

Personal ethics is an integrated part of accountants' professional life as legal regulations' knowledge might not be enough to make decisions regarding valuation methods or disclosure of information in financial reports. Moral standards change within years spent in the profession, and differs among women and men. It also depends upon the position level in the organization. That is why demographic data were collected in the survey and respondents were divided into subgroups. Charts 1-3 present demographics characteristics of subjects.

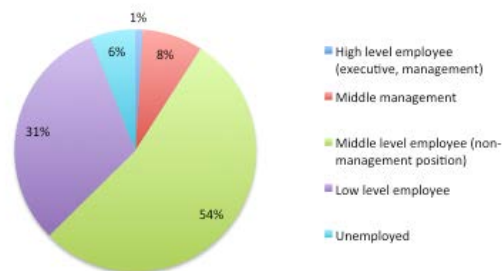Chart 1: Demographic characteristics: position level in organization



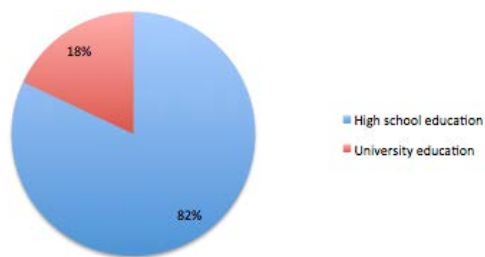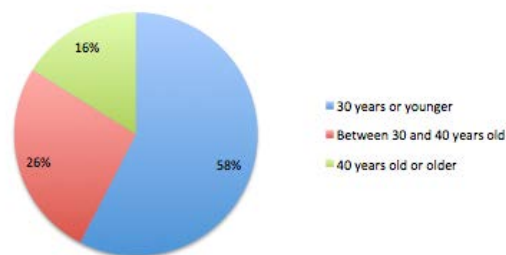Chart 2: Demographic characteristics: Level of education



Chart 3: Demographic Characteristics: Respondents' age.



Most of respondents were (82%) young women (57% of subjects were less than 30 years old) having high school level of

education (82%). 53% of respondents were middle level employees in accounting departments, while 31% are low level accounting employees. Demographic characteristics prove appropriate subjects' choice, although small group of older accountants (16% are 40 years old or older, and 26% are between 30 and 40 years old) is a limitation of the survey. Statistical analysis was mainly based on descriptive statistics that are presented in table 1.

Table 1: Survey findings and descriptive statistics.

| Statements | Arithmetic mean | Median | Min | Max | First Quadrille | Fourth Quadrille | Variance | Standard deviation | Coefficient of variation |
|---|---|---|---|---|---|---|---|---|---|
| Financial statement misinformation is ethical when supervisor asks accountant to do it | 3,13 | 3 | 1 | 7 | 2 | 4 | 2,81 | 1,68 | 53,6 |
| Accountant has no possibilities to protect from supervisors' pressure to act unethically | 4,07 | 4 | 1 | 7 | 3 | 5 | 2,67 | 1,633 | 40,16 |
| Tax evasion is ethical if accountant is the only person in his family earning money and he is afraid that refusal of fulfilling supervisors' requirements will end in dismissal from work | 2,86 | 3 | 1 | 6 | 2 | 4 | 1,96 | 1,40 | 48,9 |
| Accountants need instruments to protect them from supervisors' pressure | 5,59 | 6 | 3 | 7 | 5 | 7 | 1,29 | 1,14 | 20,3 |

Midpoint of ranked values for last statement, as well as minimum and quadrilles prove that supervisors' pressure exists among Polish accounting professionals. Other results show that supervisors' pressure to act unethically is a moral dilemma connected with accounting profession. It is statistically significant that 80% of respondents marked 5, 6 lub 7 (in seven-point Likert scale) when indicating their agreement with the last statement. Hypothesis number 1 was accepted.

A survey instrument of U Mann Whitney test (p<0,05) was used to differentiate respondents' indications between levels of education.[7] Received results of the survey carried out among Polish accountants do not vary from the results of tests carried out in the world. Persons having higher education, which typically operate at higher levels of management in organizational structure of enterprises, have a greater awareness of ethical dilemmas in accounting.

For analyses with more groups (breakdown by age, duration of work or position level in organization) the t-test for independent samples and Levene's test (homogeneity of variance; p<0,05) were used.[8] Results show that persons at the beginning of their professional life (1-5 years of work) are the least convinced about the occurrence of ethical dilemmas in accounting. Greater awareness can be observed among seniors with long professional experience.

Hypothesis number 2 was accepted, because the results show that accounting professionals lack the ability to fight supervisors' pressure to behave unethically. In Polish university education of accountants there are no courses that aim at teaching future accountants how to maintain objectivity and high standards of professionalism while being in span of control of supervisor. The survey shows that there is also a need to improve accountants' awareness concerning usage of accounting techniques to earning management. Summarizing, legal and professional instruments should be worked out to help accountants deal with the supervisors' pressure.

**3 SUMMARY**

The author of the article is convinced that accounting professionals as well as managers do not falsify financial statements. However, it is possible that one can observe

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[7] Maruszewska, E.W.: *Analysis of decision making factors concerning ethical dilemmas in accounting*. University of Economics in Katowice, Poland 2010. Not published, in Polish.
[8] Maruszewska, E.W.: *Analysis of decision making factors concerning ethical dilemmas in accounting*. University of Economics in Katowice, Poland 2010. Not published, in Polish.

unethical behaviors and practices in business organizations, that shouldn't have happened. The survey proved that even young accountants are convinced that accounting profession is in jeopardy to exercise pressure to act unethically. It is important, that at the time of unethical pressure, accountants are aware of it and are able to prevent it. To be able to turn down management pressure to act unethically one has to define ethical dilemma in accounting. Clear and proper naming of conflicts existing in the organization together with managements' and accountants' obligations taken, might be the first step in accurate answer to superiors' pressure. Dealing with dilemmas that emerged from different expectations and obligations requires competence and ability to highlight common good of the organization and social community. It also depends on how one understands leadership role of financial director or chief accountant.

Thus, when offering accounting services (whether in the form of employment contract or in any other form of rendering services) it is crucial to clearly identify the role of a person performing accounting services in the organization. Both, manager and accountant want to "win", to achieve their conflicting goals. The goals derive from personal expectations and employment obligations and there might be different and conflicting ways to achieve their goals.

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**Primary Paper Section:** A

**Secondary Paper Section:** AH, JS

# IS THE NATIONALIZATION OF THE BANKING SECTOR A SOLUTION TO THE PRESENT FINANCIAL CRISIS?

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Abstract: We argue in this paper that the institutional premises of the contemporary banking system are erroneously defined. In consequence, contemporary commercial banks cannot operate under normal circumstances as any other sector of the economy. The three core elements of the contemporary financial system – namely fiat money, fractional reserve commercial banking and central banking – imply a system which is fundamentally socialized. The most logical coherent consequence of such an institutional setting is the full control and operation of the entire credit industry by the state. The present crisis is a consequence of such an institutional setting and the nationalization of commercial banking – a logical step according to the premises of the institutional setting – will but speed up the process of a long depression.

Keywords: central banking, commercial banking, fractional reserves, nationalization, financial crisis.

The contemporary economic depression that emerged in 2007 seems to not have been concluded. At the end of 2012, central banks around the world as well as international organizations admit that the world economy in general and the large economies (especially of the United States of America and member states of the European Union) are not fully recovered. The performance of the macro-economic indicators (economic growth, inflation, unemployment and so on) seems to be volatile and uncertainty persists in what regards the future development.

Such a dynamic of the largest economies at the international level seems to question the success of the measures undertaken by governments in order to address the difficulties of the first manifestations of the crisis. The problems seem to be qualitative (in the sense of the institutional settings) and not just quantitative (such as an unfortunate context). Under this assumption, measures that should not qualify as „*business as usual*" have to be undertaken by policy makers including a dramatic change of these institutional premises on which the financial system is built.

We argue in this paper that the institutional setting of the banking sector in modern economies is confronted with core inner contradictions. As opposed to other sectors of the contemporary predominantly market economies, the banking sector experiences a product that is not related to scarcity (the fiat money) as well as a central agency that plans the aggregate production (when the central bank decides how much credit to infuse in the economy) as well as the price of the product (when the central bank fixes the rate of interest). In this context, the private ownership of the commercial banking institutions is incompatible with the institutional setting as well as the objectives of a monetary system built around central banks. Based on a wrong definition of private property rights, the market for commercial banking will always fail. In consequence, the only logically coherent organization of the commercial banking under the system of central banking should be the total control of the entire financial intermediation by the state.

## 1. Political money

As opposed to the traditional perspective on the monetary phenomenon, the contemporary financial system is built on the institution of fiat money. Classical money was a commodity which performed the function of a medium of exchange [Mises, 1981]. Its core characteristic was that its supply was limited by the scarcity of the commodity itself. No political authority could increase or manipulate the money supply as the cost of production of such money – be it mining or military conquest –

was always significant. For commodity money, there is always a floor on its purchasing power as there is a direct use value for any commodity which cannot be denied.

Modern economists have qualified however such a characteristic of the commodity money as an impediment to growth. It is not our intention to qualify here such a statement (which is grossly erroneous) but such economists have argued that such an inflexible money supply is a barrier to economic growth. In consequence, an historical process through which political authorities attempted to overpass the limits of natural scarcity of commodities lead to the adoption of the fiat money. In other words, money is considered a social convention which is entrusted to a political authority for management. They become political money whose supply is solely a political decision.

### 1.1 Fractional reserve banking

Besides the nature of the money, a financial system is fundamentally defined by the nature of credit. Financial intermediaries are those economic agents who intermediate the channeling of savings from households to private businesses and the state. An entire body of economic and legal literature has argued that the contemporary banking system is based on a faulty definition of property rights [de Soto, 2009].

In particular, the practice through banks awards loans from the capital they attract in their on-demand deposits is an aggression against the private property rights of such depositors. Economists have argued that demand deposits are fundamentally different from time deposits in the sense that they lack an explicit maturity. Commercial banks should keep such capital as readily available and meet any withdrawal from the part of their depositors with such resources. The financial intermediaries are entitled to demand a compensation for their warehousing services but, in the correct institutional setting, they should not be allowed to use such resources – even if they seem to be „*idle*" – for other uses such as financing of other clients of the bank. In consequence, in what regards demand deposits – which, by contract, can be liquidated by their depositors – the correct principle in a regime which recognizes and protects private property rights should be the rule of 100% reserves.

However, this is not the case in modern banking. The practice of private bankers to award loans from resources deposited on demand – which is an aggression against their private property rights – was sanctioned by positive law and, later, by public regulation. In consequence, private bankers benefit from a license to operate which is not met in other sectors. They are allowed to grant loans from resources they claim to be readily available for their rightful owner, the on-demand depositor.

## 2. Bank runs and the drive towards central banking

Such a commercial banking system based on fractional reserves is fundamentally unstable as the private banker that has awarded loans from the resources he claims to be readily available has engaged in a double accounting of money [Hulsmann, 2000]. He has promised the same economic good to two different clients – the debtor and the depositor. Such a double accounting is not revealed unless a significant number of depositors of the private banker demand their savings back. In this context, as the private banker cannot „*liquidate*" his assets – the loans awarded to their clients – in order to meet the payments demanded by their other clients – the on demand depositors – he will face cash flow insolvability. In other words, under such an institutional setting, commercial bankers are fundamentally illiquid.

This practice leads to a powerful drive towards the emergence of a provider of liquidity of last support, which is the central bank [Rothbard, 2009]. Obviously, under a monetary system of commodity money, such a provider of liquidity of last resort has

to operate like an insurance company as he needs to maintain his own liquidity in the case that it wants to avoid the same fate of the individual commercial bankers. However, such a scenario is less probable due to the existence of a common pool of liquidity and to the fact that money are never „*consumed*" but they will always remain in the banking system. The task of liquidity supplier of last resort – commonly called „*lender of last resort*" – is however greatly facilitated under the contemporary system of fiat money where such a central bank has also the ability to artificially increase the money supply through different mechanisms.

**2.1 Central banking: objectives and challenges**

While central banks can be perceived as a result of the special-interests pressures of private bankers on political authority, the modernity allowed other developments that have changed the relationship between private bankers and central bankers. The modern state has specific objectives in what regards the macro-economic performance of the national economy. It wants credit expansion in order to fuel economic growth and reduce unemployment.

The logical challenge to the attempt to solve the problem of prosperity in a society through increases in money supply is obviously insurmountable. An infinite money supply won't translate in an infinite affluence of the citizens. In fact, economists who support monetary expansion – such as Lord Milton Keynes [Keynes, 1953] and his followers – loose from their sight the scarcity that is characteristic to any economic good. At some point in the future, credit expansion through increases in money supply would lead to inflation and the impossibility of market participants to employ economic calculation. In an environment where the prices of economic goods modify several times per day because of a massive unrestricted money supply, the skill to anticipate future prices and their relative structure is futile.

Under the contemporary banking system, the relationship between private bankers and central bankers is manifestly asymmetric in favor of the latter. Any commercial banker is – or should be – fully aware that absent the central bank his business is insolvent unless it uses equity as a significant ratio of his resources it awards as loans. Any time such a private banker experiences withdrawals from the part of the depositors, he has to transform at least some of his assets into liquidity through the mechanisms provided by the central bank.

Central banks have the ability to infuse any quantity of money in the money markets and also fix the benchmark rate of interest for the entire economy. The fundamental mechanism is simple indeed: when central banks want macro-economic performance, they reduce the rate of interest at which commercial banks can take loans and supply enough liquidity to meet any demand from the part of the banking sector (and, indirectly, to the economy). But it is obvious that the demand for money or credit from the "*real economy*" is not an exogenous data. Such a demand is dependent on the decision of the central bank to make credit available.

**2.2 The financial intermediation from the perspective of the central banker: agency costs**

While the origin of central banking derives from particular practices of private commercial bankers, the later developments in the banking field raise a logical challenge to the nature of the contemporary commercial banking sector: why the state stopped short of taking over the entire financial intermediation? As long as the production of money and credit is fundamentally controlled by the state, why should such a state need private commercial banks in order to "*transmit*" money and credit expansion to the entire economy?

Such a dilemma becomes even more obvious when economists talk of the agency costs theory. That is agents – in our case, commercial banks – may follow their own interests – that are called "subgoals" – as compared to the interests or objectives of their principal – in our case, the central bank. While central banks follow objectives such as the rapid and efficient transmission of the money and credit expansion into the economy, commercial banks may impede such goals through:
- their value added (and especially their rate of profit) can impede the original goals of central banks to transmit the increase in the money supply to the last debtors from the real (in the sense of non-financial) economy. Independent producers at different stages of the production cycle add their profit and increase the costs to the final consumer;
- the fractional reserves force the private commercial banks into a "*race-to-the-bottom*" in their exploration of possible minimum ratio of deposits-to-loans. Moreover, if the state or its central bank imposes a floor on this competition, it will manifest itself in the risk such competitor banks assume in their crediting practices. Competition among private commercial banks under a system of fractional-reserve leads to a serious endangering of the financial system;
- the moral hazard of private commercial bankers derives from their quality of agents to the objectives of the central bankers. As long as the central bank cannot impose all the conceivable types of conduct that such private agents could follow – due to bounded rationality and the core incompleteness of contracts even for central bankers – they will always find gaps in the regulatory environment that they could exploit at the expense of their principal. Take, for example, the outrageous salaries and rewards that some banks awarded to their employees from resources received from the state through bail-outs.

**3. Why commercial banks are still not taken over by the state?**

The fact that a monetary and banking system built around the institution or central bank – which is fundamentally a socialized system – still allows the operation of private commercial banks point to possible benefits that such a structure could bring to central bankers. It is, in fact, the discussion centered on the problem of outsourcing of government services to private producers.
- despite the costs of "*competition*" in commercial banking, private enterprise in this field still allows some sort of economic calculation. In other words, the decision to nationalize the entire banking system could lead to a huge state mega-bank that is "*too big to survive*";
- the private banks still allow a better screening and monitoring mechanisms as regards the quality of the real / non-financial debtors as long as there are incentives specific to the private sector. Private commercial banks still compete in this distorted environment to attract talented individuals who are motivated by correct incentives to excel in their duties. A system based on a central bank who cannot politically decide how to compensate performance is a challenge;
- a banking system controlled by the state could allow a massive confiscation and appropriation by politicians of the rents generated by such a monopoly. Such a system could put enormous pressure on banks to allocate credit according to political or rent extracting individuals;
- the political rhetoric: such fundamentally unstable system should be thrown out on the shoulders of the market. From a political perspective, "a market failure" is better than "a government failure".

**3.1 Contemporary arguments for the nationalization of banking**

Such a short list described above is obviously somehow different from the argumentation met in public debates around this dilemma. Mainstream economists usually do not reach the debate around the legitimacy of property rights in the financial sector and the agency problems of private commercial bankers. Instead, economists like Paul Krugman have called for such a nationalization in the context of the contemporary financial crisis on, apparently, political grounds: "*If taxpayers are footing the bill for rescuing the banks, why shouldn't they get ownership, at least until private buyers can be found*" [Krugman, 2009].

According to the same opinion, there are three core arguments for nationalization:

1. "*commercial bankers are too big to regulate*" so the government takeover is the only way to make them conduct money and credit policy according to the standards proposed by the state;

2. banks cannot be allowed to fail because of the danger posed to the entire economy;

3. bailouts towards private commercial banks are not legitimate as they favor certain economic agents at the expense of the others.

In fact, even proponents like Paul Krugman seems not to be very clear when they spoke of "*nationalization*" as their language more probably refer to the nationalization of certain individual banking institutions. In fact, this economist support the idea of Alan Greenspan, former governor of the Federal Reserve in U.S.A. who concluded that "*it may be necessary to temporarily nationalize some banks in order to facilitate a swift and orderly restructuring*" [Huba and Luce, 2009]. Such an opinion seemed to be shared also by other well-known economists such as Nassim Taleb and Nouriel Roubini.

### 3.2 Contemporary arguments against the nationalization of banking

The arguments against the nationalization of the banking sector are weak and unarticulated. Nobody really opposed the massive packages of financial assistance offered by Western governments to their ailing financial sectors and especially to their banking industries. As these government measures won't produce the intended effects – which theory says that they should not – the opposition to government ownership of the entire banking sector won't find a serious opposition.

Paradoxically, the only such opposition could emerge from those economists who are sympathetic to private enterprise in general and do not perceive the massive distortions in the operation of the contemporary banking sectors. Obviously, this is the same logical error as for the supporters of the market mechanisms who are not aware of the needed institutional setting: private property rights and freedom of exchange.

### Conclusions

Capitalism, that is, a social system based on private property and freedom of exchange, is the most natural and efficient mechanism for allocation of resources and provision of correct incentives to act for private agents. However, if the mechanism of competition is based on faulty premises (that is, an erroneous system of private property), the concepts of private enterprise and market economy are devoid of any meaning. The nationalization of the banking sector under the contemporary circumstances of the financial crisis is the most coherent logical consequence of the premises on which such a sector is built. Deeper the crisis in which the economy will remain, more frequent such calls for nationalization.

Obviously, such a total take-over by the state authority of the allocation of credit in the economy won't solve the crisis and would most probably lead to further redistributive measures. The loss in welfare will be massive and socialism will be in sight.

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# INNOVATIVENESS RATIO ANALYSIS BASED ON COMPANIES' ANNUAL REPORTS

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Abstract: The article presents a possibility of extending business ratio analysis which traditionally focuses on liquidity rating, liabilities and profitability, to the area of innovativeness evaluation. In this context informative value of companies' annual reports was investigated referring to the criteria for evaluating innovation found in literature. Additionally, indicators enabling such evaluation were isolated. The culminating point of the article presents a sample innovation analysis that was carried based on specific indicators with the reference to selected companies listed on Warsaw Stock Exchange.

Keywords: innovativeness, innovation, annual report, ratio analysis.

## 1 Introduction

Nowadays, when the role of innovations as a factor giving resources new possibilities of creating added value to different interest groups, proper innovations management is regarded as the basis of a company's success on the market and as indispensable factor for realisation of its development objectives. Thus, it can be said that as beneficial situation regarding current solvency makes a company a going concern, the innovation determines its competitiveness and capacity for generating profit.

In literature innovativeness is defined in various ways, most frequently, however, it is associated with *the organisational ability to continuous search for implementation and disseminating of innovation* [Pomykalski, 2001, p. 15]. Amongst many other definitions, taking into account various aspects of this term, we should mention two more. The first formulated by J. Macias, who said that "*innovativeness represents the term that reflects the results of a company's or a group of companies innovative activity in particular time*" [Macias, 2008, p. 37]. The second, by E.M. Roger's, explains "*innovativeness means the tendency of an individual or a group to implement new ideas prior to others*" [Rogers, 1995, p. 252]. Taking into account the views of different authors on innovativeness, it is worth mentioning that in case of companies innovativeness can be associated with widely understood potential for innovation or with the actual results of innovative activity. Therefore one can distinguish between *potential innovativeness* and *resultant innovativeness*. The first one applies to widely understood assets forming the company's innovation potential (resources approach) and to increased investments in these assets (investment approach). The second innovativeness refers to both quantitative (the number of innovations implemented or introduced to the market) as well as qualitative (the degree of novelty, complexity or the technological advancement of innovations implemented or introduced to the market) results of companies' innovative activities. [Nawrocki, 2008, p. 124].

In the last decades, with the growth of importance of innovation for economic development, one can notice a regular advancement in research methodology and in methods of monitoring innovation. However, due to various differences in defining this term, several approaches towards its evaluation are encountered. It is worth mentioning that in majority of cases application of these approaches entails carrying out laborious surveys in order to find out specific information about innovative activity of tested subjects and its widely understood effects. Taking into consideration obvious drawbacks of such data collection [Turek, Jonek-Kowalska, 2010, p. 75-80], the main aim of this article is to indicate possible ways of conducting the analysis of companies innovativeness based on feasible criteria suggested in popular research methodology evaluation, using annual reports, as a main source of information.

## 2 Criteria of company innovativeness evaluation versus informative value of annual reports

In general, taking into consideration various approaches proposed by literature, with the reference to company's innovativeness evaluation, three main groups can be distinguished (table 1).

**Table 1 Different approaches to enterprises' innovativeness evaluation**

| Approach and its source | Data collection recommendations in relation to innovativeness evaluation and criteria for the enterprises' innovativeness evaluation | |
|---|---|---|
| **OECD and LBIO Methodology** | | |
| ***Frascati Methodology*** [OECD, 2002, p. 108-118] | – the number of hired employees in research and development activity and their structure (age, education, ...); <br> – costs involved in research and development activity | |
| ***Oslo Methodology*** [OECD/European Communities, 2005, p. 73-112] | *Subject approach* (company's point of view): <br> – innovative activity expenditures; <br> – results of conducted innovative activity, mainly the number of implemented innovations; <br> – the influence of company's innovative activity on its revenues, expenditures, and financial results; <br> – general indicators relating to a company's innovativeness, particularly capital intensity ratio regarding innovative activity (account of expenditures to sales revenue). <br> *Object approach* (point of view of a particular innovation): <br> – descriptive data, including: general description, type of changes, the degree of novelty, and source of innovation; <br> – quantitative data, including: expenditures, impact on innovative activity, the length of particular stages of innovation life cycle; <br> – qualitative data including,: innovation benefits, source of information and notions used in innovations, possibility of diffusion. | |
| ***LBIO Method*** [OECD/EuroStat/KBN, 1999, p. 115-117] | – innovation complexity; <br> – type of innovation; <br> – innovation properties; <br> – origin of innovation. | |
| **Methods based on resource approach** | | |
| eg. ***Diagnosis of innovations potential and company's competitiveness*** [Pawłowski, 2005, p. 62-68] | – technical and technological potential; <br> – financial potential; <br> – potential structural capital; <br> – employees' intellectual potential; <br> – business intelligence; <br> – product potential. | |
| **Methods based on time factor** | | |
| [Fell, Hansen, Becker,2003, p. 348-350] | ***Historical method*** | Implementation of an innovative solution into practice |
| | ***Cross-sectional method*** | The number of innovations put into practice at a particular point in time |
| | ***Complex method*** | Compilation of historical and cross-sectional methods |

The first one consists of various methods used by different international and national institutions (e.g. EuroStat, Central Statistical Office of Poland) to investigate periodic innovative phenomena. For European countries, the OECD methodology, that has been developed for over forty years, is regarded as the basis of the study. Within this framework we can differentiate *Frascati Manual* (recommendations regarding evaluation of companies' engagement in research and development) and

*Oslo Manual* (recommendations regarding collecting and analysing data in reference to widely understood innovative activity). The LBIO method (*Literature-Based Innovation Output Indicators)* which consists of recommendations relating to the evaluation of innovative market solutions based on the information published by technical and commercial magazines, is a supplement to the mentioned above methodology. The second group involves methods based on the resource approach, which includes the concept of strategic management, with the focus on investigating organisation's resources and skills. The example of this approach is *the diagnosis of innovative potential and company's competitiveness* by J. Pawłowski which concentrates on recognition and evaluation of causative factors relating to innovation and competitiveness of enterprise's resources. The third group consists of methods focusing on time factor, specifically emphasizing the moment of implementing an innovation in relation to the competition. Important examples of the third group are *Roger's historical method, cross-sectional and complex methods*. Clearly, apart from the above mentioned methods, there are others that can be traced in the bibliography [Jin, Hewitt-Dundas, Thompson, 2004, p. 260; Bielski, 2000, p. 156-157; Wang, Lu, Chen, 2008, p. 349-363], however, they are merely modifications or compilations.

Taking into consideration the previously made distinction between potential and resultant company's innovativeness, as well as all presented ways of its evaluation, it should be noted that *object approach of Oslo methodology, LBIO method,* and *methods based on time factor* focus on the resultant aspect, whereas *subject approach of Oslo methodology*, *Frascati methodology* and *methods based on resource approach* focus mainly on its potential aspect.

Having discussed the general situation related to different methods of a company's evaluation, and the data necessary for the application of their sub-criteria, we can now move on to the analysis of informative value of annual reports. An annual report is the most extensive and regular source of information about an enterprise's activity; and its scope, form and publication dates are statutorily defined [Journal of Laws of the Republic of Poland, 2005, No 209, item1744]. Also, national and international accounting standards, used by a particular company, as well as its information policy have a great impact on the usefulness of the information disclosed in the report. Due to the latitude given by regulators with respect to the presentation of particular elements of an annual report, information regarding the same area (most often it concerns financial reports and explanation notes) can be presented by particular subjects in various ways – different clarity and details of disclosed information. Moreover, the distinction mostly applies to presentation of information relating to the scope of innovative activity and its final results [Nawrocki, Żabka, 2011, p. 3-12].

Out of all constituents of an annual report the most informative value, when we take into account the criteria of innovation evaluation presented in Table 1, have: „*chairman's letter*", „*annual financial statement*" as well as „*management report on the issuer's activity in the annual report period*" [Nawrocki, 2012, p. 74].

In the first and in the last above mentioned element, we can find mainly descriptive information which concerns:

- products found in issuer's offer;
- organisational structure;
- work connected with extending issuer's market product range;
- issuer's technological partners and applied technology;
- investments incurred (including expenditures on research and development activity)
- main financial report points, statement of comprehensive income;
- the number of employees and their occupational structure;
- changes within issuer's organisation operational activity.

On the other hand, the middle point presents quantitative information referring to assets and sources of funding, obtained in the period sales revenues, costs incurred and cash flows. It should also be noted that from the perspective of the previously mentioned criteria for the innovativeness evaluation, a particularly valuable constituent of an annual report, are explanation notes in additional information, especially those which refer to:

- within financial report (balance sheet):
  - detailed classification of all the assets and the shareholders' equity and liabilities;
  - detailed range of changes in values of specific generic group relating to fixed assets and intangible and legal assets (including changes connected with current depreciation and accumulated depreciation);
- within total income statement (profit and loss account):
  - the structure of net income sales;
  - generic costs;
  - projected and incurred expenditures on fixed assets, intangible assets and legal values (including expenditures on research and development activities).

Taking into consideration the above information present in an annual report, it should be noted that although it does not allow for conducting a complete evaluation of a given subject's innovativeness, it still offers a useful source of data.

With the reference to the evaluation of potential innovativeness, annual report information enables for implementation of investment criteria extracted from OECD *methodology* (*innovation activity expenditures* and *capital intensity ratios for research and development activity* as well as *innovative activity*) and also resource criteria derived from OECD methodology *(the number of employees involved in an innovative activity)* and diagnosis methods of competitive and innovative enterprise potential (*financial potential, structural capital potential, technical and technological potential, employees' intellectual potential*). On the other hand, as far as resultant innovativeness evaluation is concerned based on annual report information, it is possible to use first of all the basic quantitative criterion, based on Oslo methodology and cross-sectional method (*the number of innovations introduced to the market or implemented by the company at a particular point in time*). Also descriptive and qualitative criteria can be used with the Oslo methodology (*the degree of novelty from market's point of view, diffusion possibility and innovation characteristics*) and LBIO method (*complexity level, type of changes and the origin of innovation*).

**3 Business innovativeness indicators**

If we concentrate just on the quantitative indicators of innovativeness evaluation, based on typical relations used in financial ratio analysis [see: Bednarski, Borowiecki, Duraj, Kurtys, Waśniewski, 2003, p. 263-294], that can be applied on the basis of annual report information, and if we omit all financial evaluation criteria, we can distinguish 9 main innovativeness indicators within three groups:

- indicators of innovation potential inherent in company's resources (5);
- companies' involvement indicators in innovative activity (3);
- companies' resultant innovativeness indicators (1).

The knowledge in the form of intangible and legal values is the main financial company's asset that influences company's innovation potential. It applies to all the licenses, concessions, patents and capitalised costs connected with development work as well as machinery and technical equipment. Hence, the most general indicator referring to company's innovative potential, except for balance value of the above financial recourses, is their *share in total assets*:

$$SinA_i = \frac{Bv_i}{A} \cdot 100\%, \qquad (3.1)$$

where:

$i$ – particular asset, important from innovative potential point of view (for *licenses, concessions and patents* $i = LCP$; for *capitalized costs of development work* $i = CDW$; for *technical equipment and machinery* $i = TEM$);

$SinA_i$ – *share* of $i$- constituent in assets;

$Bv_i$ – balance value (net) $i$-of the asset;

$A$ – total assets.

Fundamentally, the greater participation of the above mentioned components in assets in general, the higher evaluation of innovative potential of a particular enterprise. It should be noted that for the company in order to function effectively, apart from pointed financial resources, other tangible and current assets are needed. Therefore, total participation of the above mentioned resources in assets of the companies does not exceed 60-70 %.

Taking into account the fact that both knowledge in the form of intangible and legal values, as well as technical equipment and machinery, are subject to depreciation, according to accounting standards, in order to allow for loss in value, due to usage and time, another important indicator informing about innovation potential can be mentioned in a form *of the degree of novelty* in relation to mentioned assets. In general this indicator can be represented as:

$$DofN_i = 1 - RI_i = 1 - \frac{R_i + Nwd_i}{Gv_i}, \qquad (3.2)$$

where:

$DofN_i$ – the degree of novelty of $i$-asset;

$RI_i$ – redemption indicator of $i$-asset;

$R_i$ – redemption (accumulated amortization) of $i$-asset;

$Nwd_i$ – net write-downs due to update of $i$-asset value;

$Gv_i$ – gross value of $i$-asset.

The calculated novelty degrees of the particular components of knowledge in the form of intangible and legal values as well as technical equipment and machinery, are supplement to redemption indicators. The range of their values is between 0 and 1, where 0 refers to complete amortization and 1 refers to total newness of the particular asset and large innovative potential at the same time.

Apart from intangible and tangible assets, based on annual report information, in the evaluation of a company's innovative potential, human recourses can be accounted for. The basis for the evaluation is the main qualitative criterion within OECD methodology, that is *the number of employees involved in an innovative activity.* It should be noted though, that detailed presentation of employment structure is not a common practice within companies, and the actual capabilities of using this criterion are often limited. Therefore, in this case, *evaluation of human capital,* is regarded as the more useful measure of innovative potential. Based on expense approach [Czarnecki, 2011, p. 63; Bombiak, 2011, p. 91]. Such evaluation per employee can be calculated using the following formula:

$$HC_p = \frac{S+B}{E}, \qquad (3.3)$$

where:

$HC_p$ – the human capital evaluation (employees resources) per employee,

$S+B$ – employees' salaries and benefits,

$E$ – number of employees

Obviously, from company's innovative potential point of view it is essential for the evaluation of human capital (per employee) to represent the highest possible level.

As far as the second group of indicators is concerned (companies' involvement indicators in innovative activity) except for *expenditures* on mentioned earlier financial resources, two relative indicators can be distinguished, presenting relation of expenditures to different economic categories, characteristic for the company – the intensity of expenditures and renewal of assets.

*Expenditures intensity ratio,* like expenditures, refers to the group of the basic criteria, of company's innovation evaluation mentioned in Oslo methodology, however as opposed to expenditures, its values are not directly conditioned by the size of the tested subject. This indicator can be presented with the following formula:

$$EXint_i = \frac{EXn_i}{S} \cdot 100\%, \qquad (3.4)$$

where:

$EXint_i$ – the expenditures intensity ratio per $i$-asset;

$EXn_i$ – net expenses (increase – decrease) incurred per $i$-asset,

$S$ – net proceeds from sales of products, goods and materials.

The presented above relation shows how much of obtained net proceeds from sales is used by the company for innovative activity as far as particular resources are concerned (research and development work; licenses, concessions, patents; technical equipment and machinery). Therefore the greater values of expenditures intensity ratio, the better company's involvement in the development of innovative potential in the specific area.

The second mentioned indicator – renewal of asset constituent – is a supplementation to the formerly described two criteria relating to company's involvement evaluation in innovative activity. It is regarded as the real measure of changes relating to financial resources and it is represented by the following formula:

$$Re_i = \frac{In_i - \left(De_i - Am_{De_i}\right)}{Am_i + \Delta Nwd_i}, \qquad (3.5)$$

where :

$Re_i$ – the renewal indicator of $i$-asset;

$In_i$ – gross increment value of $i$-asset in a given period;

$De_i$ – decrease in gross value of $i$-asset in a given period;

$Am_{De_i}$ – amortization relating to $i$-asset, whose gross value decreased in a particular period;

$Am_i$ – amortization of $i$-asset in a particular period;

$\Delta Nwd_i$ – net write-downs (increase – decrease) due to loss in value of $i$-asset in a particular period

Generally speaking, fixed asset renewal indicator, shows to what extent the company renovates particular asset components due to their physical and economic use. If values of the indicator are higher than 1, it means the company renew particular asset in a wider range than it is used, which is positive and as far as involvement in innovative activity is concerned. On the other hand, indicator values below 1, particularly below 0, are characteristic when assets are used faster than they are renewed which is regarded as a negative situation.

As far as resultant notion of company's innovation evaluation is concerned based on annual reports, a single indicator can be presented – *the number of innovations implemented, or introduced to the market, by the investigated subject at the particular time* (within Oslo methodology it applies to three year period). At the same time, the mentioned indicator can be used separately to investigate various effects of company's innovative activity such as products, processes, organisational and marketing results.

Summing up the discussion about company's innovation indicators, one should remember that like in case of relation within financial ratio analysis, their values can substantially vary according to investigated industry.

## 4 Innovativeness ratio analysis on the example of selected companies listed on Warsaw Stock Exchange

The practical application of innovativeness' indicators discussed in the previous part of this article was presented on the example of five electromechanical companies listed on Warsaw Stock Exchange, which concentrate their activity on the production of testing and measuring equipment as well as transmitters. They are: *The Apator S.A. Group* (CG Apator), *The Aplisens S.A. Group* (CG Aplisens), *The Automation Machinery Plant „Polna" S.A.* (Polna), *The Relpol S.A. Group* (CG Relpol) and *The Sonel S.A.* (Sonel). The innovation analysis of the mentioned subjects was conducted based on published annual reports referring to the period of 2008-2011. In case of companies, that are organised in the form of capital group, consolidated reports were the source of data. In addition, as a complementary source

of data for resultant innovativeness evaluation, public database of Polish Patent Office was used [PPO database, access: November 2012].

The results of the analysis were presented in the following diagrams in the order of formerly discussed groups of innovativeness' indicators. Due to the limitations of article's volume their interpretation was presented at the end of this point.
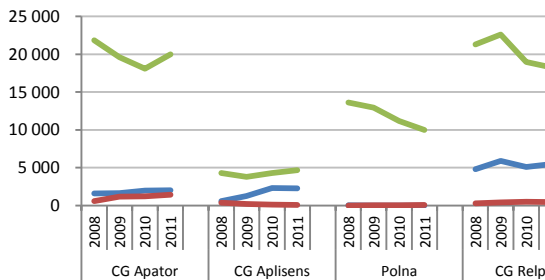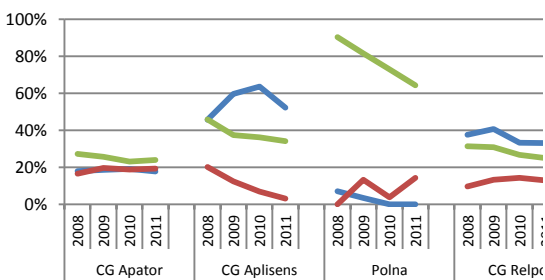


**Fig.1    The balance value (thousand PLN) of development work capitalised costs (CDW), licences, concessions, patents (LCP) and technical equipment and machinery (TEM).**
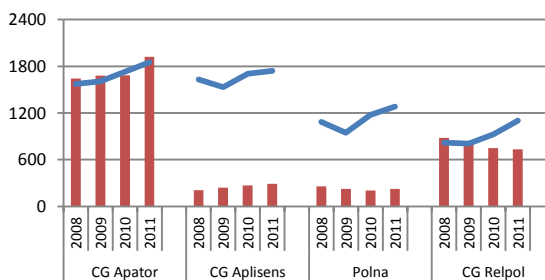Source: own work based on the data from investigated companies' annual reports.
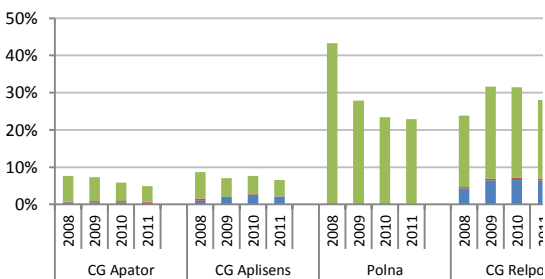


**Fig.2    The share of development work capitalised costs (SinA CDW), licenses, concessions and patents (SinA LCP) and technical equipment and machinery (SinA TEM) in total assets.**
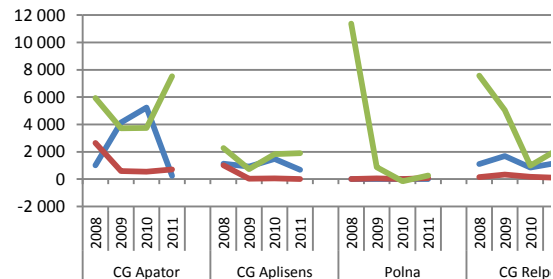Source: own work based on the data from investigated companies' annual reports.



**Fig.3    The degree of novelty of development work capitalised costs (DofN CDW), licences, concessions, patents (DofN LCP) and technical equipment and machinery (DofN TEM).**
Source: own work based on the data from investigated companies' annual reports.



**Fig.4    The number of employees and human capital evaluation per employee (HCp).**

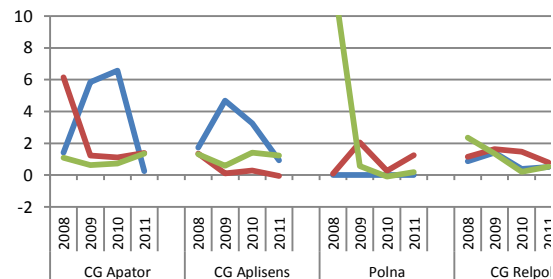Source: own work based on the data from investigated companies' annual reports.



**Fig.5    The net expenses (PLN) on research and development work (Exn R+D), licenses, concessions, patents (Exn LCP) and technical equipment and machinery (Exn TEM).**
Source: own work based on the data from investigated companies' annual reports.
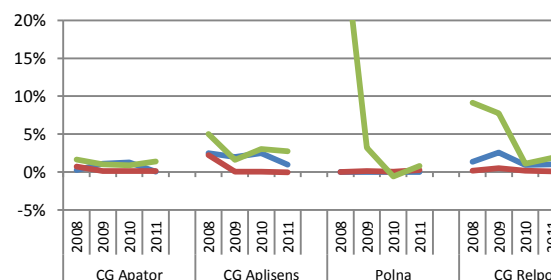


**Fig. 6    The expenditures intensity ratio of research and development work (EXint R+D), licences, concessions, patents (EXint LCP) and technical equipment and machinery (EXint TEM).**
Source: own work based on the data from investigated companies' annual reports.



**Fig.7    The renewal of research and development work (Re R+D), licenses, concessions, patents (Re LCP) and technical equipment and machinery (Re TEM).**
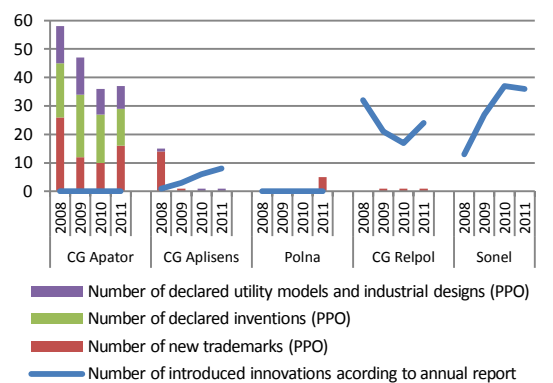Source: own work based on the data from investigated companies' annual reports.



**Fig.8    The effects of innovative activity of investigated companies.**

Source: own work based on the data from investigated companies' annual reports and database of Polish Patent Office.

After examining the results several conclusions can be made referring to investigated companies in the particular areas of analysis:

- Balance values of featured assets and their proportion in total assets show evident superiority of technical equipment and machinery over knowledge of intangible and legal values (which is regarded to be inconsiderable as far as licenses, concessions and patters are concerned). Sonel and CG Relpol are the only exceptions.

- The novelty degrees of particular assets indicate over 50 % redemption of investigated companies. Therefore it is difficult to note here a considerable innovative potential. The best position in this area is presented by Sonel and CG Aplisens, however there is a downward trend observed.

- Of all the investigated companies, CG Apator presents the most significant human capital, where a large number of employees relates to their high quality evaluation. Only Sonel shows slightly better results in this area and CG Aplisens results are comparable to CG Apator.

- As far as research and development activity involvement indicators are concerned, all surveyed companies present poor results – expenditures incurred are unstable in time and of low standards. Sonel is the small exception however some considerable downward trends have been observed recently
  in this company.

- In relation to effects of innovative activity, CG Apator and Sonel's work has been positively evaluated, followed by CG Relpol. By far the worst are Polna and CG Aplisens by hardly presenting any achievement information.

Summing up, it can be concluded that Sonel company indicates the best results in innovativeness ratio analysis however it should show more involvement in innovative activity to achieve even better effects. The innovativeness of CG Apator, CG Aplisens and CG Relpol is fairly satisfactory. By far the worst results in all the areas of innovativeness analysis presents Polna.

**5 Conclusions**

The proposal of extending business ratio analysis towards its innovativeness was introduced in this article. It is a compromise between a complete evaluation of this notion based on methods found in literature, and the possibilities of obtaining information from companies' annual reports. It should be mentioned that the clarity of some annual reports is rather poor as far as information is concerned, however it has been improving every year. It can be suggested that the reports will become a more concise and reliable source of information with the reference to companies' innovative activity. It will be useful in the process of evaluation if more indicators could be applied. However, nowadays the amount of information obtained from annual reports allows for the analysis of the companies' innovation within three main dimensions – innovative potential, involvement in innovative activity and the results of such activity. Though it is not the complete analysis, at the same time its scope is sufficient enough to obtain certain knowledge in this area in investigated companies.

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# ECONOMIC ASPECTS OF THE CULTURAL SECTOR IN POLAND

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Abstract: The purpose of this article is to present the economic aspects of the cultural and creative industries and the current levels of expenditure from national budget, local authorities and households on culture in Poland. Its first part discusses the relationship between economics and culture, to continue with the economic analysis of the cultural sector and creative industries as well as of the expenditures of the national budget, local authorities and households on culture, followed by a comparison of the situation in Poland with that in other countries. The analysis was developed on the basis of data published by the Ministry of Finance, the Ministry of Culture and National Heritage, data from the 2011 Household Budgets Survey, the Central Statistical Office of Poland, the Eurostat and the Polish report on the economic significance of cultural sector (Lewandowski *et al.*, 2010).

Keywords: economics of culture, cultural sector, creative industries

## 1 Relationship between culture and economy

Cultural values and ethical standards are the function of the society which determines the traditions and identity of the habits and customs. Man as a social being functions within a system of multiple social ties. A society is a community of social beings, rooted in the common cultural values and ethical standards supported by the society's economic, cultural, educational and political institutions that promote integration of its constituent groups and communities. The quality of social life is determined by a hierarchy of cultural and ethical values (Szołtysek, 2009).

The concept of 'culture' requires a clarification. Culture is a word that we use in different ways. Sometimes, it denotes a general sense of community: shared eating habits, shared religion, shared priorities and values. However, it can also denominate a signal of the underlying activity – something that carries a message about the world we live in and the life we lead. It is just what the artists express in their novels, sculptures and works of music. According to this interpretation, culture teaches us something or allows some experience (Hutter, 2011).

The 2004-2013 National Strategy for the Development of Culture emphasizes that beyond the intangible, social benefit, the investments made in the area of culture also have their purely economic dimension. It is recognized that – with proper management – every dollar invested in the sphere of culture offers its multiple in the annual return. The amount of investment in a cultural project, in addition to social and educational advancement of culture participants, also gets multiplied in the supporting environment of cultural industries, providing employment to many people and contributing to the gross domestic product. Investment in the social infrastructure development in the area of culture can, like any other public expenditure, function as a development multiplier.

Reliable data and information on the facts and trends in cultural policies as well as on the available public funds and methods of direct / indirect financing of the cultural sector are needed especially now, in the times of economic crisis. Lack of funds is almost universally invoked as an explanation of the stagnation or decline in cultural sector financing and in financing all types of cultural activities: protection of cultural heritage (a good example is the partial collapse of Pompeii in Italy), patronage in the area of music and visual arts, the operation of ministries of culture and important cultural institutions (as evidenced by liquidation of the UK Film Commission) or small voluntary cultural associations and organizations that are fighting for survival (Bodo, 2011).

The *Needs analysis and the development of creative industries* report prepared for the Ministry of Economy concludes that there is a need to broaden the scope of economic analyses of the cultural sector to include the creative industries. The Conference of German Ministers of Economic Affairs has identified the creative industries as follows: the creative industries are broadly construed to include the creative businesses that are market-oriented and deal with the creation, distribution and/or dissemination of creative goods and services through the media. Results obtained in one of the first studies that have been conducted in Poland to identify the differences between both sectors (i.e. culture and creative industries) in terms of their economic performance and individual industries' shares are presented below.

## 2 Cultural sector

The presented report on the cultural and creative industry, *Economic Significance of the Cultural Sector*, was developed by Instytut Badań Strukturalnych [*Institute for Structural Research*]. The main objective of the study was to identify the economic significance of the cultural sector in Poland. The report was prepared on the basis of data available for the year 2008. In order to evaluate the contribution of the cultural and creative industries to the national economy, the analysis focused on identifying the contribution of their product (value added) to the total value added generated by the economy, or the Gross Domestic Product. For both categories, their share in total employment was calculated.

Table 1. Value added and employment

| Value added generated by the cultural sector and creative industries, 2008 [€M] | |
|---|---|
| Creative industries: | 6,721 |
| of which cultural sector: | 4,299 |
| Employment in the cultural sector and creative industries in 2008 [persons] | |
| Creative industries: | 375,858 |
| of which cultural sector: | 260,616 |

Source: Lewandowski, P., Mućk, J., Skrok, Ł. *Znaczenie gospodarcze sektora kultury* [*Economic Significance of the Cultural Sector*]. Warsaw: Instytut Badań Strukturalnych, 2010.

The process of culture shifting from non-profit to market orientation gives rise to the need of viewing the traditional cultural sector as a component of the wider area of creative industries. Thus the product generated by the cultural sector during that period amounted to about 4.29 billion euro, while the total product of creative industries was about 54% higher and exceeded 6.72 billion euro. In 2008 over 260,000 people were employed in the cultural sector, whereas the figure for creative industries was higher by 44% and stood at nearly 375,000. The above figures translate into the 2008 contribution to Polish GDP at the levels of 1.6% for the culture sector and 2.5% for the creative industries [Lewandowski *et al.*, 2010].

Table 2. Structure of value added and employment in the Polish cultural sector by industry, 2008 [%]

| Industry | Value added | Employment |
|---|---|---|
| Publishing | 28.7 | 17.5 |
| Broadcasting | 22.1 | 6.8 |
| Libraries, museums and monuments of history | 20.2 | 22.4 |
| Cable TV services | 8.9 | 2.2 |
| Creation, distribution and showing of films, video and TV programmes | 5.8 | 4.7 |
| Sales of newspapers, books, music and video recordings | 4.5 | 13.9 |
| Literary and artistic creativity, art institutions' activities | 3.9 | 24.1 |
| Antiquities trade | 3.4 | 7.1 |

| Sound and music recordings | 2.4 | 1.3 |
|---|---|---|
| Reproduction of recorded media | 0.1 | 0.1 |

Source: Lewandowski, P., Mućk, J., Skrok, Ł. *Znaczenie gospodarcze sektora kultury* [*Economic Significance of the Cultural Sector*]. Warsaw: Instytut Badań Strukturalnych, 2010.

In the cultural sector, the largest value added (over 1.22 billion euro) was generated by the publishing companies. However, the structure of employment was predominated by industries related to the artistic and literary creation and the activities of cultural institutions such as libraries, museums, theatres and art galleries. The analysis of the value added structure suggests a high degree of concentration of the product generation. Nearly 75% of the cultural sector's product was generated by publishing, broadcasting and libraries, museums and monuments of history. The first two industries contributed more than a half of the 2008 total added value of the cultural sector The other industries together generated the equivalent of the value added produced by publishing. About 47% of the sector's total workforce are employed in the industries related to artistic and cultural activity, another 17.5% in publishing and as much as 14% in the sale of newspapers, books, music and video recordings [Lewandowski *et al.*, 2010].

## 3. Creative industries

Extension of the analysis scope to cover the creative industries, and not only the cultural sector, produces a share increase – in the overall value added by more than a half, and in the total employment by more than 40%.

Value added is an economic variable describing the size of product generated by an enterprise, industry or economy, less the cost of materials consumed.

The value added of the cultural and creative industries is their sum.

$$VA = \sum_{i=1}^{s} VA_i$$

where:

*VA* is the value added produced by the cultural sector and creative industries,

$VA_i$ is the value added generated by the *i*-th industry, and

*S* is the number of industries covered by the substantive scope of the analysis (higher for the creative industries than for culture).

Employment is an economic variable representing the number of people employed within an enterprise, industry or economy. Due to the insufficient amount of data, it is impossible to adjust employment by time factor.

Employment in the cultural sector and creative industries is defined as the sum of respective employment figures for the industries covered by the adopted definition of these industries.

$$E = \sum_{i=1}^{s} E_i$$

where:

*E* is the number of people employed in the cultural sector and creative industries, and

$E_i$ is the number of people employed in the *i*-th industry.

Table 3. Structure of value added and employment in the Polish creative industries by industry, 2008 [%]

| Industry | Value added | Employment |
|---|---|---|
| Advertising | 18.5 | 14.6 |
| Publishing | 18.3 | 12.1 |
| Broadcasting | 14.1 | 4.7 |
| Libraries, museums and monuments of history | 12.9 | 15.5 |
| Architectural services | 7.3 | 7.0 |
| Cable television service | 5.7 | 1.5 |
| Software publishing | 4.2 | 2.9 |
| Creation, distribution and showing of films, video and TV programmes | 3.7 | 3.3 |
| Sales of newspapers, books, music and video recordings | 2.9 | 9.6 |
| Literary and artistic creativity, art institutions' activities | 2.5 | 16.7 |
| Antiquities trade | 2.2 | 4.9 |
| News agencies | 2.0 | 1.2 |
| Specialized design / other design services | 1.9 | 2.2 |
| Sound and music recordings | 1.6 | 0.9 |
| Organisation of trade fairs, exhibitions and congresses | 1.2 | 1.2 |
| Production of toys | 0.6 | 0.9 |
| Professional photography services | 0.4 | 0.7 |
| Reproduction of recorded media | 0.1 | 0.1 |

Source: Lewandowski, P., Mućk, J., Skrok, Ł. *Znaczenie gospodarcze sektora kultury* [*Economic Significance of the Cultural Sector*]. Warsaw: Instytut Badań Strukturalnych, 2010.

The largest input to generating value-added is provided by advertising, which accounts for almost 20% of creative industries product and 15% of their employment. When summed with the two largest industries of cultural sector – publishing and broadcasting – these three largest industries produced over 50% of the value added of creative industries. A significant contribution is also brought in by software publishing, cable television services and architectural services, which together account for about 17% of the value added of creative industries, or about 0.4% of total GDP.

To sum up, the largest creative industries in Poland in terms of product were advertising and publishing. This means that both the advertising industry, strongly related to the development of market economy and providing B2B services, and the publishing industry that to a large extent uses foreign creativity were far more significant for the national economy than the other industries (especially those assigned strictly to the cultural sector) that often deliver non-marketable goods. Conversely, the latter occupied the dominant position in the structure of employment. This suggests the importance of public provision of culture in Poland, especially where low productivity is typical. It is worth noticing here that the above-average productivity occurs in the relatively capital-intensive industries like broadcasting, cable television services and recording. The labour-intensive sectors, e.g. sales of cultural goods, trade, libraries, museums and monuments of history, but also literary or artistic creativity, show low levels of value added per employee. If, however, as a result of public choice it is deemed desirable for the goods and services produced by these industries to be delivered (e.g. for the sake of public benefit), then there is a need for governmental intervention to finance the operation of these industries in full or at least in part (Lewandowski *et al.*, 2010).

## 4. Household spending on culture

The analysis of expenditures of the national budget, local authorities and households on culture presented here was made on the basis of data published by the Ministry of Finance, the Ministry of Culture and National Heritage as well as data from

the 2011 Household Budgets Surveys conducted by the Central Statistical Office of Poland.

In 2011, the average annual spending on cultural goods and services in Poland amounted to €98.96 per person. The share of spending on culture in the total household expenditure was 3.3%.

In 2011, the largest items of households' expenditure on culture were the cable TV fees – €33.89 per person on average (34.3% of total spending on culture). Expenses on radio and television subscription amounted to €7.99 (8.1%), while on the purchase of TV sets - €8.98 (9.1%). Purchase of newspapers and magazines households entailed the expense of €9.22 per person (9.3% of spending on culture), while purchase of books and other publications (excluding textbooks and other educational books and magazines) as well as the theatre, music institutions and cinema tickets cost €4.71 per person (4.8%).

Table 4. Possession of selected household articles of cultural use in different cultural socio-economic groups in Poland, 2011 (pcs per 1000 households)

| Households of: | TV set | Personal computer | Camera |
|---|---|---|---|
| Manual workers | 1,417 | 941 | 743 |
| Office employees | 1,373 | 1,263 | 990 |
| Farmers | 1,489 | 857 | 696 |
| Self-employed outside agriculture | 1,484 | 1,335 | 1,028 |
| Old-age pensioners | 1,241 | 364 | 398 |
| Disability pensioners | 1,165 | 332 | 301 |

| Households of: | Satellite or cable TV receiver | DVD player | Radio or radio-cassette player |
|---|---|---|---|
| Manual workers | 765 | 662 | 602 |
| Office employees | 782 | 661 | 574 |
| Farmers | 597 | 599 | 777 |
| Self-employed outside agriculture | 856 | 687 | 614 |
| Old-age pensioners | 597 | 338 | 792 |
| Disability pensioners | 530 | 286 | 727 |

Source: Central Statistical Office

In 2011, the most popular article of cultural use in households was a TV set, owned by 98.4% of households. The number of households owning personal computers grew from 64.9% in 2010 to 66.7% in 2011, including those with Internet access (from 59.6% to 62.3%). A satellite or cable TV signal receiver was owned by 67.6% households (in 2010 - 64.5%). In 2011, one in six households were equipped with a home theatre system, and one in ten had a video camera.

**5. Government's and local authorities' spending on culture**

In 2011, the Polish government's expenditures on culture and national heritage protection (including grants and subsidies to local authorities) amounted to 364.32 million euro, while the expenditures of local authorities (including transfers between them) stood at 1,647.46 million euro.

With such transfers between local authorities excluded from calculation, the 2011 total of national and local public expenditure on culture and national heritage protection was 1,970.07 million euro. A majority of public expenditure (82.4%) was made from the budgets of local authorities (83.4% in 2010).

With transfers to local authorities included in the calculation, the government's expenditure on culture and national heritage protection accounted for 0.5% of the total public expenses. This means that public expenditure on culture and national heritage protection amounted to €9.54 per population head.

When we look at the structure of public expenditure on culture and national heritage protection, most (i.e. 991,90 million euro or 25.2%) was allocated to the operation of museums, while protection and conservation of monuments of history and other activities for the protection of historic sites cost 56.41 million euro (15.5%). Another significant item of public expenditure were the expenses related to the operation of culture and art centers as well as theatres, which accounts for 41 million euro (11.3%) and 38.51 million euro (10.6%) respectively. The functioning of archives got allocated 28.97 million euro (8.0%), libraries – 21.34 million (5.9%), and philharmonic halls, orchestras and choirs – 12.34 million (3.4%).

In 2011, local authorities spent 473.78 million euro on the operation of cultural centers, clubs and community centers (28.8% of all local public spending on culture and national heritage protection) and 287.46 million (17.5%) on libraries. Financing of museums and theatres cost 178.56 million (10.8%) and 171.71 million euro (10.4%) respectively. Local authorities funding of the protection and conservation of monuments of history and other activities for the protection of historic sites amounted to 113.51 million euro (15.5%). They spent 68.34 million euro (4.2%) on art and culture centers, while functioning of philharmonic halls, orchestras and choirs cost them 67.78 million (4.1%). Finally, local authorities allocated 0.32 million euro to the operation of archives.

**6. Polish and other countries' expenditure**

Polish spending needs to be looked at in the context of other European Union countries. Such a context was provided with data presented by the Eurostat in their publication of *Cultural Statistics*. The analysis covered the most developed countries, with the highest growth rates, where much attention is paid to various aspects of culture: Germany, the United Kingdom, France, Italy and Austria. The selection was broadened by adding two countries who, like Poland, joined the EU only in 2004 and underwent transformation from socialist to market economy in 1989, i.e. the Czech Republic and Slovakia.

Table 5. Number of persons employment in cultural sectors, 2009 ('000s)

| Country | Population in 2009 | GDP per capita |
|---|---|---|
| Germany | 82,002,356 | 29,400 |
| France | 64,350,759 | 29,600 |
| UK | 61,179,256 | 25,300 |
| Italy | 60,045,068 | 25,200 |
| Austria | 8,355,260 | 32,800 |
| Czech Republic | 10,467,542 | 13,100 |
| Slovakia | 5,412,254 | 11,700 |
| Poland | 38,135,876 | 8,100 |

| Country | Total employment | Cultural sectors employment | Cultural sectors employment (% of total) |
|---|---|---|---|
| Germany | 38,797 | 847.2 | 2.2 |
| France | 25,704 | 437.3 | 1.7 |
| UK | 28,923 | 597.1 | 2.1 |
| Italy | 23,025 | 246.7 | 1.1 |
| Austria | 4,078 | 64.1 | 1.6 |
| Czech | 4,934 | 63.1 | 2.3 |

| Republic | | | |
|---|---|---|---|
| Slovakia | 2,366 | 26.1 | 1.1 |
| Poland | 15,868 | 222.0 | 1.4 |

Source: Eurostat

In comparison with the EU countries selected for the study, Poland has the lowest GDP per capita. Employment in the cultural sector is largest in Germany, the UK and France, and smallest in Slovakia. In Poland a relatively large number of people are employed in the cultural sector, but in relation to total employment and population this sector's rate of employment is higher in the Czech Republic.

The level of education is usually considered one of the factors determining participation in culture. Therefore the study also covered an analysis of the selected countries' populations in terms of education (Table 6).

Countries with the largest 25-39 years-old population with tertiary education are France, the UK and Poland. Conversely, this group is smallest in the Czech Republic, Italy and Slovakia.

Table 6. Educational attainment of population by age group, 2009 (%)

| Country | 25 – 39 y.o. | | |
|---|---|---|---|
| | low | medium | high |
| Germany | 13.9 | 59.5 | 26.5 |
| France | 17.6 | 41.4 | 41.0 |
| UK | 19.4 | 41.4 | 39.2 |
| Italy | 33.0 | 47.9 | 19.1 |
| Austria | 12.6 | 66.3 | 21.1 |
| Czech Republic | 5.5 | 76.2 | 18.3 |
| Slovakia | 5.1 | 75.9 | 19.0 |
| Poland | 7.0 | 61.1 | 31.9 |
| | | | |
| Country | 40 – 64 y.o. | | |
| | low | medium | high |
| Germany | 14.8 | 58.9 | 26.3 |
| France | 36.7 | 41.8 | 21.4 |
| UK | 29.1 | 41.0 | 29.9 |
| Italy | 53.5 | 34.8 | 11.7 |
| Austria | 30.7 | 39.4 | 29.9 |
| Czech Republic | 10.8 | 75.6 | 13.6 |
| Slovakia | 12.0 | 74.6 | 13.4 |
| Poland | 15.4 | 70.7 | 13.8 |

Source: Eurostat

A very large increase in the number of young people with university education is visible in France (an increase of over 20%) and Poland (ca. 18%). Austria is the only country that recorded a decrease of over 8% in the number of people with higher education among the younger generation; in Germany the situation remains practically stable. Other countries record increases of a few percent. The largest population with low education is found in Italy.

Table 7. External trade in cultural goods, 2009 (€M)

| Country | Exports | Imports | Balance 2009 |
|---|---|---|---|
| Germany | 4,279 | 2,399 | 1,880 |
| France | 2,317 | 2,044 | 274 |
| UK | 4,489 | 3,068 | 1,421 |
| Italy | 833 | 719 | 115 |
| Austria | 548 | 981 | -433 |

| Czech Republic | 396 | 287 | 109 |
|---|---|---|---|
| Slovakia | 121 | 94 | 27 |
| Poland | 499 | 179 | 319 |

Source: Eurostat

An important element in the study of culture economics is the market for cultural goods. The European Union in its reports on the creative industries development emphasizes the importance of such development. The economic performance of a country is affected by the volumes of its imports and exports. Export capacities of individual countries make the basis for identification of the developmental capacity of their cultural and creative industries. The largest export revenues are enjoyed by Germany and the United Kingdom. Only in Austria more cultural goods are imported than exported. On the one hand, it is indicative of individual countries' potential for the production of cultural goods, and on the other, the volume of imports may help identify the level of a country's recognition of the importance of acquiring foreign cultural goods.

Expenditure on education per capita is largest in Austria, the UK and France, and smallest in Poland, Slovakia and the Czech Republic (in this order). Most is spent on recreation and culture per capita in France, Austria and the UK, and the least again in Poland, Slovakia and the Czech Republic. France spends six times and Germany over four times more on recreation and culture than Poland, with their respective populations just twice (Germany) and over one and a half times (France) larger (Table 8).

Table 8. Total general government expenditure on recreation, culture and education by country, 2010 (€M)

| Country | Population | Education | Recreation and culture |
|---|---|---|---|
| Germany | 82,002,356 | 106,320 | 20,830 |
| France | 64,350,759 | 115,834 | 28,743 |
| UK | 61,179,256 | 118,663 | 18,903 |
| Italy | 60,045,068 | 69,321 | 12,703 |
| Austria | 8,355,260 | 16,306 | 2,953 |
| Czech Republic | 10,467,542 | 7,209 | 2,049 |
| Slovakia | 5,412,254 | 2,944 | 788 |
| Poland | 38,135,876 | 20,026 | 4,758 |

Source: Eurostat

**7. Conclusions**

In the times of economic crisis, it becomes essential to refine the methods of measuring the economic significance of cultural goods and services. The social impact of culture has been emphasized for many years. The need to protect the cultural heritage and to offer public support to the promotion of culture has been recognized, especially in the areas requiring a financial input from the government. It becomes important to carry out a detailed identification of the industries whose existence depends on public support, the more so that they usually belong to the so-called high culture, where the audience have sophisticated tastes and are relatively small in number (it is often emphasized that the high culture is consumed by the social and intellectual elite). Frequently these industries (opera, philharmonic, theatre, museums, etc.) require a huge financial support from the government, as shown in the chapter on the governmental and local authorities' spending on culture. In 2011, these expenses constituted 0.5% of the total public expenditure. Increasingly, however, there is emphasis on the need to identify the creative industries or the cultural industries which do not require aid and whose operations generate large profits. The economic analysis results presented here indicate that their economic performance (in terms of value added and employment rate) significantly affect the rate of economic growth of a country.

At the time of a dynamic growth in reaching the audiences by means of state-of-the-art technologies, cultural statistics can no longer be handled in the traditional way. On the contrary, the methods of cultural statistics must be continuously improved. The EU-27 countries largely differ in their methods of processing and classification of statistical data on culture in its broad sense, which causes some incomparability of the statistics supplied by the Member states. Enhancing the quality of data would require harmonization of the statistical methods applied by the member countries.

Poland made an attempt to demonstrate the differences between the economic performance and employment in the cultural sector both alone and expanded by additional sectors to form the creative industry. The differences are large indeed, even if the authors point out that their results are not complete as despite the wide scope of study, we could not get all the information about specific industries.

The Central Statistical Office of Poland carries out annual surveys on households' spending on culture, which allows tracing changes in the significance of spending on culture in relation to other expenses. The comparisons are not optimistic. Data show that in 2010 urban dwellers spent €6.94 per person per month to buy books and other publications and another €6.76 on tickets for theatres, cinemas and music institutions, while the respective spending of rural areas' residents on the same articles used cultural amounted to €1.73 and €1.81. Households spend more than twice as much on alcoholic beverages, tobacco products and drugs as on education. Monthly household spending on alcoholic beverages, tobacco products and drugs averaged €6.57 (€5.39 in rural areas), while the spending on education averaged €3.11 (€1.73 in rural areas).

However, as shown in Table 4, TV sets are owned by as many as 98.4% of households, and many households own more than one. The number of home computers keeps increasing year over year (62.3% of households in 2011). The smallest number of computers can be found in the households of old-age and disability pensioners but this is also a function of age - older people are less likely to use computers, and some have never used one. The largest cultural expense of households is the subscription fee for cable television services, i.e. a mass culture service.

Looking at Poland in the European context, it lags behind the eight EU countries selected for comparison in virtually every respect, except in the size of well-educated population of the 25-39 age group. Poland has the lowest GDP and it spends the least on education, recreation and culture. However, the growing rank of Poland is noticeable as regards the development of creative industries. The reports prepared in Poland and the economic policies pursued in Poland during recent years has focused on facilitating the development of creative industries, which could bring an improvement in both the statistics and the standard of living of the Polish population. Yet, the translation of concepts into the actual implementation is not going to be easy and smooth.

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# IDEOLOGICAL SOURCES OF THE ECONOMIC DEMOCRACY AND ITS HISTORICAL DEVELOPMENT

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Abstract: In the paper, the author elucidates the fundamental characteristics of the economic democracy. Therefore, the concept is also introduced through its historical development beginning in the 18th century up to present day. Particular space is devoted to the development of the concept in both theory and practice of the former Czechoslovakia. The focus is on the ideological diversity of the authors developing the concept of economic democracy, as well as the heterogeneity of the interpretations of its content.

Keywords: economic democracy, employee participation, profit sharing, cooperatives, workers' councils, company ownership

## 1. Opening reflection

Steadily deteriorating social position of workers in many strata of the population, in the most developed regions of the world as well, combined with a gradually intensifying elimination of the opportunities for their active participation in decision-making processes at the macro and especially micro levels of the companies, are the evidence of the need for search of an appropriate alternative to the more or less successfully realized versions of both capitalism and socialism, which are both seemingly the only two forms of economic and political organization of the society. On the outwardly simple but true dichotomous model of an arrangement of the great collectivity of humanity mentioned above, i. e. society, Marx and Engels (1948: 39) pointed out vigorously in the mid of the 19th century. They grounded both the "bourgeoisie and proletariat" into the irreconcilable conflict as two "great classes directly facing each other". The division may seem to be anachronic as a result of the creation of the so-called information society. In connection to this "it is not fashionable to talk about class these days, certainly not about a "capitalist" class" (Schweickart, 2002: 106). "Contemporaneousness is a witness of the institutionalized confrontation of both the modern capitalism and the employees (workforce), where in a market economy there is a clash of competing interests" (Kováčik, 2009a: 95). It is apparent that, despite its long life and various ideological accretions, aforementioned *class polarization* is still up to date. Even the existing political parties of the capitalist (or – using Dahl's terminology – polyarchic) world still derive their existence and associate the promotion of their interests, and fight for voters with the help of this polarization.[1]

Long-acting globalization of particular economies, augmented by occasional but very large fluctuations in the world economy, materialized in the form of economic and financial crisis, coupled with the ever increasing pauperization of the broad segments of the population, especially in the underdeveloped countries, with virtualization of the financial sector, and the wage polarization of workers in different areas of the economy, caused many seemingly irreparable damages. Apocalyptic visions of the world and the fate of its inhabitants do not help the recovery. Also, various economic experiments and destructive political ideologies have been hampering the possibility of a more radical revision of those ways of decision making which had destabilized the economic, political and social order of the world.

It seems that in contrast to political power which is constant (each voter has one vote), economic power exceedingly grows: almost each holder of capital holds progressively more capital (cf. Ringen, 2004: 19). These factors significantly contribute to the destabilization of the population's certainties of life. The current situation of the world economy and the long-lasting existence of factors negatively affecting the status of the workers around the world, both require acute and complex solutions. "The structure of modern corporate organization points out the need to supplement the existing system of citizens' political rights with a similar set of rights, but this time concerning the sphere of labour law [...]" (Kováčik, 2009b: 150-151). This new system of rights is represented by the so-called theory of economic democracy (do not identify with Downs' economic theory of democracy). The theory has been given only slight attention in Slovak and Czech scientific literature, as well as in the entire Central-European set of scientific publications. This theory has been particularly elaborated in the American political and economic science for decades, and is a major milestone in the feasibility of the democratic mode application in the field of economic units, i. e. the enterprises or privately owned firms.

In the following text, I will try to outline the basic principles of economic democracy, pointing to its anchorage in the sphere of political ideologies, more specifically to the ideological sources that the economic democracy theorists have been drawing from. By giving the examples of specific cases, I will try to illustrate the history of the development of the concept of economic democracy on a theoretical as well as on a practical level. Special room in this historical "conjunction" of the economic democracy will be dedicated to the history of Czechoslovak, or more accurately Czech tradition of the employee participation, which is a phrase that can to some extent be regarded as synonymous with the term economic democracy.

## 2. Features and principles

In general, it is hardly possible to identify various theorists' views on what constitutes the content of economic democracy (henceforth, E. D.). Nevertheless, the views of individual authors can be summarized into the list of three main features, which give an appropriate picture of what is the quintessence of E. D. Such delimitation will facilitate a fluent transition to the identification of its main ideological assumptions. The aforementioned features are:

I. *All workers directly share the ownership of the enterprise they work in.* It means that the "ownership of the firm is entirely in the hands of some or all of its employees" (Hansmann, 1998: 43). Such participation on the ownership is frequently realized through the sale of shares to employees (Adamová et al., 2001: 40).[2] It is based on the assumption that "if employees are co-owners of the company, the motivation to work is greater because their final reward depends on this as well. They are motivated alike private owners in a case of the ownership of the enterprise" (Blaha, 2009: 389). It is important to realize, however, that the share-principle of the employees does not bar the socially vulnerable population from the opportunity to work in this type of business. By "socially vulnerable population" I mean those who cannot become the co-owners because of the lack of the financial resources. Sharing the ownership of the enterprise is not a category that would be added "extra" to the job title. To put it simply, profit-sharing is automatic, the employee becomes a co-owner of the enterprise simultaneously along with the signing of the employee contract.

In this context it should be noted that such workers' sharing of the company ownership is not identical to what some authors

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[1] "Political parties under capitalism have historically represented different class interests: slave owners versus employers of wage labor, landed capital versus industrial capital, farmers versus dwellers, capital versus labor. Of course, parties must always cast themselves as representing universal interests and must appeal to an electorate beyond the narrow bounds of class, but the longevity and stability of political parties, when they are long-lived and stable, have depended on their representing distinct and enduring *class interests*." (Schweickart, 2002: 153-154; italics: M. S.). On the other hand, as pointed out by Andrew Heywood, today there is "a departure from the old class polarities and shift to new political issues, such as the environment, animal rights and feminism..." (Heywood, 2008: 319).

[2] The transferability of these shares is feasible only with difficulty, or cannot be achieved at all.

describe as "shareholder democracy", where the weight of the voice (or votes) of an individual is equal to the number of the shares she owns. Dahl (1995: 298) writes that "democracy requires that each citizen's vote should be counted equally, a requirement that cannot be met by equal sum of the votes for each share". This is a difference between traditional capitalist firm where the number of votes is identified with the number of shares (one vote per share), and "economic-democratic" enterprise operating on the basis of "one person – one vote". It may therefore seem that certain egalitarianism cannot be avoided. On the other hand, one can imagine a situation where employees of a democratically-managed enterprise will be divided into groups according to the type and complexity of work performed. Appropriately, these groups will be allocated a number of shares per employee. The principle of equality, however, will have to be preserved; i. e. the number of shares does not affect the weight of the vote. An analogous situation is also common in democratic elections when citizens choose their political leaders. Regardless of the size of the property, each voter has just one vote.

II. Employees – shareholders *freely and democratically choose their immediate supervisors – managers, according to the principle: one person – one vote*. These supervisors are akin to "administrators" of the enterprise. Their activities are subordinated to other company employees who participate in and control their decisions. Managers are to those employees (as to their electors) accountable and consult all their major decisions with them, particularly those with long-term effect on the activity of the enterprise and its employees. Of course, the strategic decisions of particular importance are not the privilege of a narrow circle of managers, but remain the responsibility of the whole community of workers. An important question is the method of choice regarding the election of these managers. As the income of workers is proportional to the financial health of the company, it is natural that each person will be prone to select only highly qualified and well-trained managers (cf. Schweickart, 2002: 61).

Since the company, like a state, according to Robert Dahl (1985: 115) can be seen as a political system in which relations of power exist between governments and the governed. The workers, in terms of E. D., can be called "members" (Ehrenberg, Ljunggren, 2003: 15; Dahl, 1985: 104), or – as Dahl (1985: 109) also calls them – "citizens-members", or simply citizens of a firm (Dahl, 1985: 118; Svensson, 1995: 202).[3] In general it is presumed that the citizens of the state have the best knowledge of what problems need to be solved in their country and where the possible lacks of the governance reside. According to their right of vote and their conscience and belief, the citizens choose their political representatives who they deem to be eligible to solve the practical problems stemming from everyday practice. We may apply the same argument put forward in the theory of E. D., to advocate employees' choice of managers. Employees "are in daily contact with the firm's operations, and are knowledgeable about some aspects of them; and they are easily organized for collective decision making" (Hansmann, 1990a: 307). It means that "they are better informed about the enterprise, because they have the information right from the source" (Svensson, 1995: 204). This co-presence of the employees at the management of the firm is benefited by the usage of practical knowledge and skills coming from the employees and thus enhances their initiative with the aim to improve the labour organization and to upgrade the technology used in the firm. Related to this, it is worthy to remark that though a democratic firm is governed as a unit by its employees, some competencies may be delegated. However, this cannot be confused with the allocation of the competencies. Dahl (1985: 118) comments that „citizens (in terms of employees, as mentioned above, M. S.) are competent to decide whether they

are themselves sufficiently qualified to make the decisions collectively through the democratic process; and on matters they do not feel competent to decide for themselves, they are qualified to set the terms on which they will delegate these decisions to others."

In terms of manual workers and managers, it is also necessary to add that the wage differences amongst these two groups of workers are not very remarkable as we can behold in regular enterprises of free market economy. Generally manager's wage does not exceed 4.5 times the amount of a manual worker's wage (cf. Blaha, 2009: 395).[4]

The demand of democratically elected managers is decisively not created upon unrealistic foundations. Direct calls for the application of this managerial modus could be found in the works of numerous distinguished theoreticians, of whom we may mention John Rawls. In his accomplished work *A Theory of Justice,* he states that firms "are for example governed by wokers' councils or managers elected by them" (Rawls, 1995: 172). Similarly declares I. Wallerstein (1998: 78) when solving the issue of firm's efficacy, he asks for the necessity to "assure some form of workers' participation on a high level decision making". Slightly differently, but in the same spirit, Michael W. Howard (2007: 418) gives the right to vote to the employees, as well: "Managers are hired by a board of directors elected by the workers, on the basis of one person, one vote".[5]

III. The third characteristic feature is the *employees' participation on the profit sharing or covering the firm's losses*. Whereby we may also apply the same consensual principle which is also put forward at the aforementioned employee governance and firm's management.

All of these characteristics forming E. D., as well as their relation to free market, are clearly illustrated in the following scheme.

**Scheme:** Foundations and principles of the economic democracy
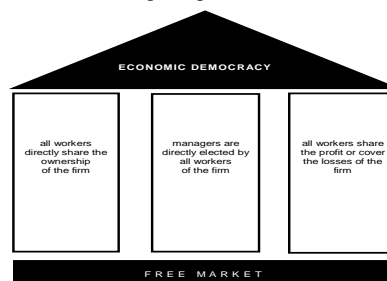


**Source:** the author

### 3. Ideological connotations of the definition

The concept of E. D. is viewed differently by various theoreticians. We may conceive it to be inherently bipolar. Firstly, as a "theoretical curiosity" and on the other hand as an "ideological aspiration" (cf. Hansmann, 1998: 43). Its "pure" form means, simply put, that "every worker is an owner and every owner is a worker" (Lane, 1985: 624). It also involves "various forms of collective worker participation in important decisions at the workplace" (ibid.). The authors of various

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[3] As Dahl (1985: 114) points, „Unlike citizens of a state, one might object, workers are not compelled to obey managerial decisions; their decision to do so is voluntary. Because a worker may choose to obey the management or not, because he is free to leave the firm if he prefers not to obey, and because he cannot be punished by management for leaving, some would argue that his decision to obey is perfectly free of all compulsion."

[4] Dahl (1985: 106-107) explains similarly when he writes that "within self-governing enterprises the distribution of income and wealth would be significantly less unequal than it will be in a system of corporate capitalism."

[5] David Schweickart (1992: 19-20) aptly describes this feature of E. D. writing: "Each productive enterprise is managed by those who work there. Workers are responsible for the operation of the facility: organization of the workplace, factory discipline, techniques of production, what and how to produce, how the net proceeds are to be distributed. Decisions concerning these matters are made democratically: one person, one vote. In a firm of significant size some delegation of authority will doubtless be necessary. A workers' council or general manager (or both) may be empowered to make certain kinds of decisions. But these officials are elected by the workers." Similarly Dahl (1985: 104) writes: „In self-governing enterprises, the members themselves would decide on the principles according to which wages, salaries, and surplus were to be distributed among the members."

ideological paradigms and schools are biased when dealing with the issue of E. D.[6] Before the fall of the iron curtain, E. D. was frequently seen as a "middle way" between the corporatist and "imperialist" American capitalism and the dictatorial Soviet etatism (cf. Christie, 1984: 113).[7] Nowadays, the concept is familiar among some leftist scholars, who promote it most vigorously. They adopted the Marxist scheme of a class-divided world and thus call for ultimate transformation of the capitalist system. Appropriately put by M. Fisher in his publication *Capitalist realism*: "We need to formulate a strategy of struggle in a relation to work and to those who control it. We have to enforce an authentic autonomy of the employees..."

However, individual leftist authors are not united over the interpretation of E. D. They construe it as: a) a form of socialist alternative to capitalism, opposing the "capitalist mantra" mostly popular in the 80s during Thatcher's and Reagn's government, also known as TINA: „There is no (viable) alternative (to capitalism)", b) as "the successor-system to capitalism" (Schweickart, 2002: 171), c) as a *condicio sine qua non* of the "political democracy" which "would become a purely formal institution, if not accompanied by an adequate economic, social, cultural and moral background" (Hába, 2007: 272) or d) it is used as a theoretical concept subordinated to "social-democratic" understanding of economics and law (e. g. Ehrenberg & Ljunggren, 2003).[8] This view is fully acceptable for economic neoliberals, such as Michael Novak. He (Novak, 1992: 106) labels the E. D. as a "socialist ideal" which he characterizes as a "subordination of the economic system to the political control". Such ideologization of the E. D. concept is therefore not surprising, since – as Drew Christie (1984: 119) correctly notices – "economic democracy draws on two great traditions of political thought. From the liberal tradition, it takes the emphasis on political and civil liberties, the call for equal opportunities, the belief that inequalities of the distribution of wealth must be justified... From the socialist tradition, economic democracy takes the conviction that great inequalities in wealth are inherent in capitalism, a concern with the nature and organization of work, a belief that undemocratic modes of organization severely limit the realization of the liberal's call for political and civil liberties, and a rejection of the conception of property rights prevailing in Western democracies" (ibid.). She also adds that this combination of the two ideological streams "lead some to conclude that economic democrats form the left wing of the liberal tradition and others to conclude that it is the libertarian (bourgeois?) wing of the socialist tradition" (ibid).

The problems of ideologization have been recently commented by David Miller (2003), one of the most famous current political theorists. Although he uses the term "market socialism", its meaning is the same as the one of E. D., as we shall see. He claims that "[t]his is not the communist utopia favoured by Marx and other radical socialists..." Miller tries to find the right meaning of the "market socialism" by connecting it with the social justice. According to him (op. cit.: 90-91) "the pursuit of social justice may point us towards a form of market socialism in which economic enterprises are owned and controlled by those who work in them, rather than by outside shareholders, so that profits can be shared among the actual producers". In his earlier work *Market, State, and Community: Theoretical Foundations of Market Socialism* (1989) he even suggests that "co-operative economy could provide an alternative, market-based, economic model for socialism in the West" (Carter, 2003: 2). This, to some extent eclectic approach, also points out that the concept of E. D.

or we may say market socialism or cooperative economy (these terms can be used as equivalents), converges to the aforementioned theory of the transformation of capitalism. Surprisingly, some support of E. D. can be found even among right-wing theorists, especially because, as Neil Carter noticed, it turns workers into "risk-bearing entrepreneurs by forcing them to raise money in the capital market" (Carter, 2003: 3). On the other hand, many contemporary Marxists are sceptical about the possible existence of "islands of socialism" flourishing in the "sea of capitalism". They behold the fact that democratically operating businesses "cannot avoid the determinism of the market, which imposes capitalist principles of organization, such as hierarchy, wage differences and low wages" (ibid.). These businesses cannot ultimately succeed by any other way than by the transformation of the "classical" capitalist enterprises. Consequently, it means that "if they fail to conform, they will fail as economic enterprises" (ibid.).

The implied ideological connotations of E. D. do not indicate only the influence of liberal and socialist tradition but the political democracy and capitalism itself, as emphasises R. E. Lane. In general, "support for political democracy would seem to promote workplace democracy, while support for capitalism would seem to retard it" (Lane, 1985: 627). A paradox outlined by D. Robertson (2004: 237) is that "a full-blooded theory of industrial democracy, however, is an entire rival theory both to capitalism and to communism's system of state ownership". However, we may not only find theoreticians who often ideologize E. D. As Henry Hansmann (1990b: 1810) wrote at the beginning of 1990s, also common Americans saw workers' ownership, one of the basic features of the E. D., as "socialistic and therefore evil".

Sandra L. Albrecht (1983), unlike other authors, does not ideologize E. D., but she considers it to be one of the many participatory forms, nominally: „collective bargaining" (also called "conflictual" or "adversarial" participation) – the basic thesis of which is that "equal parties come together to negotiate the terms of employment" (Albrecht, 1983: 48). She also includes into the participatory forms "Workers' Representation on Boards – Codetermination", „Joint Consultation and Information – Works Councils", "Humanization of Work", and "Self-management and Workers' Ownership" (an example of this type of participation is the former Yugoslavian economic system).[9] Robert E. Lane attempts to gain an ideologically unbiased approach. He includes in the concept of E. D. "all substantial shifts of power from management to workers, therefore excluding minor forms of grievance procedures, token profit sharing and pro-forma representation on a board of directors" (Lane, 1985: 624).

Despite the existence of apparent inability to define E. D., there are some attempts to define it most eloquently. Christie (1984: 113) defines it as an "egalitarian form of political-economic structure in which a serious attempt is made to democratize the economic sphere, including workplaces". Albrecht (1983: 58) depicts it as "the transfer of decision-making rights of the economy from the few to the many". Dahl (1985: 91) considers "a system of economic enterprises collectively owned and democratically governed by all the people who work in them". Giovanni Sartori (1993: 12-13) characterizes E. D. in two levels: 1) "this notion denotes democracy, the political aim of which is redistribution of wealth and equal accessibility to economic possibilities and conditions"; 2) "economic democracy relies on the application of equality, as far as the control of economic production process is concerned". The mentioned author amends its Marxist view according to which E. D. "does not anticipate political democracy, on the contrary, it is being excluded and substituted" (ibid.). David Schweickart (1992: 19) clearly and undoubtedly adjusts E. D. to his ideologically stigmatized view of reality marking it as a "worker self-managed market socialism", which „presupposes political democracy" (ibid.). After all, Nadia Johanisová attempts to create her own (rather

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[6] „Industrial democracy or industrial participation (...) is espoused in a surprisingly wide range of ideological positions" (Robertson, 2004: 237).
[7] Dahl (1985: 55-56) expresses in a similar way: "...I want to consider whether it might not be possible to find an alternative to corporate capitalism that would be just as efficient and would at the same time enhance the values of democracy, political equality, and political liberty."
[8] Authors attempting to forcibly identify E. D. with socialism or some form of it may, however, be pejoratively labelled "useful idiots", using the famous Lenin's words, which formerly named the Western leftist intellectuals, who uncritically and enthusiastically adopted Marxist philosophical elements into their own (bourgeois) thinking. They were called "useful idiots" because of talking about both Marxism and socialism as of good ideas, whose only method of implementation in history had been proven wrong.

[9] More see in Albrecht (1983: 47-58).

specific) definition, regarding E. D. (similarly like Schweickart) as "a corollary of political democracy and a *sine-qua non* of true democracy" (Johanisová, 2007: 28).[10] Johanisová together with Wolf (2012: 564) subsequently describes the E. D. "as a system of checks and balances on economic power and support for the right of citizens to actively participate in the economy regardless of social status, race, gender, etc."

The basis of all these efforts to find an appropriate definition of E. D. is the thesis postulated by D. Bell according to whom "the arrival of market economy and industrial revolution was not voted for" (Bell, 1999: 220). This definition could be supplemented with Swedish trade unions motto of the 1930's: "Democracy cannot stop at the gates of factories" (Blaha, 2009: 385). This quote remotely resembles the motto of American revolutionary struggle for independence: „No supervision without representation", since – as Drew Christie (1984: 114) warns us – "For many writers the principal consideration favouring economic democracy is that it would be the fulfilment of the democratic promise: people have a right to a say in the decisions that seriously affect them". Furthermore, a key issue addressed by all theoreticians, which is the starting point of their thought, is following: "Why are the democratic rights of citizens valid only in the relation towards the state, but not in the relation to private companies?" (Blaha, 2011: 70).

### 4. Genesis and historical development

Economic democracy is decisively not a new concept that could be found only of late. Eloquently put by former American Secretary of the Treasury A. Gallatin at the end of the 18th century: "The democratic principle on which this nation was founded should not be restricted to the political process, but should be applied to the industrial process as well (cited in: Derber, 1973: 599). Certain characteristic features of this concept may be already identified on the verge of the 18th and 19th century in the work of François Marie Charles Fourier (1771-1837) who is classified amongst the so-called social utopists. As one of the first theoreticians, or more likely, as a perceptive observer of the socio-economic relations of his time, he noticed a considerable amount of negative effects of the laissez-faire policy in the evolving capitalist society. The only tool he saw to eradicate these negative social effects, were the "gatherings on cooperative basis" (Křivský, P.: Osobnost a dílo Charlese Fouriera, in: Fourier, 1983: 165). In the 2nd half of 19th century, some signs of E. D. can be found in organizations, which preceded the current trade unions movements, but we may also find these signs in the work of J. S. Mill. At the beginning of the 20th century this idea was extensively developed by the Fabians.

### 4.1 Indications of the economic democracy in the 18th and 19th century

The thought of social utopists, notably the one of Ch. Fourier, was marked by the influence of social changes which were inherent to the society of the 2nd half of the 18th century and the beginning of the 19th century. The society was defined by continuous change of social relations from bourgeoisie to capitalist type. From the ideological point of view this change owed to the thought of freedom born during the Great French Revolution. As Fourier (1983: 56) declares in his *Théorie de l´unité universelle*, "the most malign of all mistakes of our century is the spirit of freedom, abstractedly good and praiseworthy, but in practical use so deliberatively evil, that it had brought even the supporters of freedom under the flag of despotism. An unpleasant test proved that these beautiful theories are full of illusions and disgracefulness".

Along with emphasizing the aforementioned changes of living conditions in the society, the social utopists called for the idea of equality, which became their fundamental principle. The demand of equality "had been transferred into the sphere of ownership and among some utopists later manifested itself as egalitarianism - a demand of proprietary equality of all the members of the society" (Hába, 1975: 56).

Ch. Fourier applied this claim into his particular concept of new organization of social life based on the phalanstères, "big production-consumption units with a harmonious division of work" (Zamarovský, V.: Charles Fourier, in: Zamarovský, 1961: 238). It is remarkable, that already in the year 1822[11] he realized, that "workers who work slowly with a striking unhandiness (as long as they are wage workers), are more diligent if they work for themselves. As the first issue of political economy, it would be necessary to consider the question of how to change all the employees to co-owners with common interests, i. e. to companions" (in: Zamarovský, 1961: 278).[12] In Fourier′s concept of economic unit, an individual can take part in the allocation of the works outcomes "at the same time as a shareholder, a worker and a manager" (Křivský, P.: Osobnost a dílo Charlese Fouriera, in: Fourier, 1983: 166).

The production and political relations were to be organized upon cooperative principles, thanks to what each member could have been an owner as well as a co-owner and a shareholder. (cf. Adamová et al., 2001: 186). This was supposed to motivate the workers to maximize their output. As Valeš (2007: 240) alerts, "wage-work relationship and constrain to work were terminated. Each one worked for his own, the success of all became the success of the individual. The concept of phalanstèr is different from the later Marxist notion of communism since it retains features of private ownership as it is divided "into small shares, so that each member can easily become a co-owner of commune capital" (Hába, 1975: 54).

The phalanstèr itself differs from a simple commercial cooperative and its meaning considerably exceeds the cooperative (cf. Křivský, P.: Osobnost a dílo Charlese Fouriera, in: Fourier 1983: 165). Fourier aimed to unite the members of the phalanstèr "under one roof" not only because of the objective of commune work, but also community life (cf. ibid.). This may be seen as one of the most utopian features of his work. Relating to the thought of Enlighteners, Fourier attempted to "radically change the social environment" (op. cit.: 166) by spreading the system of phalanstères. Inventiveness of his idea resides in the fact that "it opposes capitalistic egoism and individualism with the attempt to create an organization of producer cooperatives, which by rationalizing the production maximalizes its affectivity. In these producer cooperatives, the interest of an individual identifies with the interest of a collectivity. Production, consumption and allocation will create a harmonious relation. Production completely subordinated to consumption won't be managed by the perspective of profit and its imbalances and won't be the cause of unemployment crisis. Poverty will perish since everyone will have the right to work and will be eligible for minimal existential benefits and social security" (ibid.). Ch. Fourier can be defined by some sort of universalism, which meant nothing more than that the future world should have been, according to his ideas, "covered by a network of phalanstères, connected to each other in a free federation which will tackle national and ethnic differences and assures happiness, freedom, justice and perpetual peace to mankind" (op. cit.: 168). In the same sphere, the late conceptions of Marxists about global spread of socialism and its continuous transformation into perfect communist society seemed no less utopic than the ones of Fourier. Later, the reformist movement of producer and consumer cooperatives followed his heritage. Though we may find some ideologic affinity among Fourier′s phalanstères and

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[10] Johanisová also suggestively writes on E. D., in her afterword to Feierabend's book on the agricultural cooperatives: "If the control of a political power subsists in a political democracy, then the control of an economic power subsists in an economic democracy" (cited in: Feierabend, 2007: 135). Ehrenberg and Ljunggren (2003: 1) go even further claiming that "the question of economic democracy is in a globalised world perhaps a question of the survival of political democracy".

[11] The year of publication of his work *Traité de l´association domestique et agricole*.
[12] He also writes a little later in the mentioned file *Théorie unité de l'universelle*: "As the first problem of the national economy, it would therefore be necessary to resolve the issue of how all wage earners should be turned into the involved co-owners or shareholders" (Fourier, 1983: 106).

these cooperatives, their objective is different. One of the examples of this affinity is that in both cases we are dealing with voluntary economic units. While Fourier tried to create a new autarkychic world in his phalanstères, cooperatives were deeply rooted in the already-existing world and respected its rules (cf. ibid.).

Despite the fact that Fourier as a theoretician stood alone with his plans and his expectations of a maecenas, who would financially support his visions, were not fulfilled, his theory was echoed in the works of equally famous philosopher J. S. Mill. Mill was well familiar with Fourier′s work and the work of another renowned utopic socialist – C. H. de Saint-Simon (see Valeš, 2007: 225). Mill too realized that "freedom and social justice in society should be in order. If the evolution won´t move forward towards the synthesis of entrepreneurial initiative and participation of all the workers in "the outcome of commune work", the class conflict will deepen, what will bring disastrous consequences for both sides" (Valeš, 2007: 230). The strongest thoughts on E. D. resound in his file *Principles of Political Economy*, where he expects progressive transformation of firms into a form, where employees will decide "on terms of equality, collectively owning the capital with which they carry on their operations, and working under managers elected and removable by themselves" (Mill, 1994: 147). He even assumes that capitalists themselves – closely watching the progress of cooperative firms – will lend their capital to these firms. Thanks to this a social settlement will be reached and new industrial relations will come into being. Everyone in this system will work in the name of universal good, aiming to reach social justice (cf. Mill, 1994: 155-156).

At the end of the 19th century, we may identify some misty indications of E. D. in the work of associations such as (American) Knights of Labor, staunch supporters of worker cooperatives. These associations emphasised the need to create producer and consumer cooperatives as the alternatives to capitalism (see e. g. Howard, 2007: 424). Ľ. Blaha also draws attention to the existence of "producers′ self-governance" notion in political thought and practice dating back to the 19th century. This notion might be related to the establishment of cooperative movements in Germany (cf. Blaha, 2009: 351-352).

**4.2 Expansion of the economic democracy notion in the 20th century**

It is undeniable, as Albrecht (1983: 43) states, that the increased effort of the international movement for the participatory democracy connected with the demand for workers′ rights in decision making has been observed mainly since the late of 1960s. On the other hand, as it was indicated above, concrete efforts of this type can be dated back at least to the period of the early 1920s. These efforts are associated especially with the Fabian society activities. Fabians' basis was the intellectual heritage of already mentioned J. S. Mill.[13] In 1922, Sidney James Webb and his wife Martha Beatrice Webb published *Industrial Democracy*, where they present the so-called industrial democracy as "the democracy of industrial units" (Sartori, 1993: 12). In this publication they rely on James Stirling′s *Trade Unionism*, which was published for the first time in 1869 (cf. Derber, 1973: 604). The industrial democracy of the Webbs is "the adjustment of direct Greek democracy to the industrial society, where the member of political community, polités, is replaced by a member of economic community" (Sartori, 1993: 12). However as pointed out by G. Strauss and E. Rosenstein (1970: 201), the thought of employees′ control over the workplace was rejected as incompatible to the efficiency by British Fabians, German Revisionists, thus the socialist authors of the Reformist school. This way of thought saw Socialism notably as a public control of the economy. "Behind this rejection of direct workers control was a mistrust of workers abilities to prefer the interests of the public to their own narrow ones. The early reformists did not encourage the formation of

any work councils even for the purpose of advising management" (ibid.). Even before the evolution of the industrial democracy notion, Beatrice Webb herself initiated the establishment of a cooperative movement in her book *Cooperative Movement in Great Britain* (1891). However, it is necessary to add that in the mentioned work she refused the idea of producer cooperatives and preferred consumer cooperatives, what made her a part of the Cooperative Federalism school. Charles Gide (1847-1932), a French theoretician of economy, was also a member of this school and worked through the theory of cooperativism in his work *Les Societes Cooperatives de Consomption* of the 1904. The exponent of the so-called Cooperative Individualism school was the Swiss economist and the founder of the Lausanne school of political economy – Léon Marie Esprit Walras (1834-1910). He along with Frenchman Jean-Baptist Léon Say (1826-1896), grandson of the famous Jean-Baptist Say, founded the bank for producer cooperatives in 1865. A year after they started to publish the monthly *Le Travail* (The Work). Unfortunately, both projects ended in failure in 1868.[14] Whilst the activities of cooperativism theoreticians in the 19th century might be labelled as "primal impetuses", the exponents of cooperative movement from the beginning of the 20th century tried to reach a transfer from capitalism to socialism through a general and mass organization of people as mass consumers, based on the cooperative principle, which was a later to dominate not only in business, but as well in industry and agriculture. This was to create "an all-comprising social formation of a socialistic character" (Dado, 1966: 289).

The ideas of the Webbs were later taken up by another Fabian and the main representative of the Guild socialism – George Douglas Howard Cole (1889-1959), according to whom "genuine political democracy would only be achieved when industry was organized on a participatory basis and employees became self-governing in the workplace" (Lansbury, Prideaux, 1981: 325).[15] The idea of the industrial democracy appeared again later, during the 60s and the beginning of the 70s in the USA, as a response to the main questions, which emerged with bipolar contest not only in the level of practical policy, but mainly in the scope of mutual theoretical clashes of both capitalist and communist ideas (see Blumberg, 1971). It is worthy to note that the idea of employees′ participation impersonated the 4th point out of 19 in the Iranian reform programme of the White Revolution in 1963, fuelled by later deposed ruler – Shah Mohammad Reza Pahlavi. According to this programme, the employees′ share of the net profit was set at 20 % in the private sector companies.

In the period of Great Depression a new thesis starts to spot, concerning the theory of capitalism transformation, one of the theoreticians of which was e. g. J. A. Schumpeter. This thesis about the "democratization of capital" evolved from a concept, according to which "along with the development of public limited companies and issuing of shares with low nominal value, the overall number of shareholders increases and thus the capital is being democratized, since great masses of population take part in the ownership as well as they take part in decision making" (Ekonomická encyklopedie, 1984, 1st vol.: 168). According to this theory, the market could be reformed through the changes in the structure of ownership, control in the workplace, or changes the values, attitudes and behaviours of workers (cf. Carter, 2003: 3). It is due to remark that this idea was not met by praise geographic area of liberal democracies of the former West, as well as amongst the dogmatic Marxists of the "Real Socialism" countries. This is also verified by the criticism of Ľudovít Korček in his book *O teóriách „transformácie" kapitalizmu* (On theories of capitalism "transformation") of 1972, which should be viewed through the prism of the era it was written in. "Share

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[13] Cf. Valeš, 2007: 237.

[14] According to Cirillo (1980: 300) – Walras, realizing the difficult position of social workers, believed that the solution of the social question lies in the transformation of everyone into a capitalist. This could be achieved through the public ownership of the land, in other words: nationalization. More on his economic though see e. g. Dado (1966: 874), Ekonomická encyklopedie (1984, 2nd vol.: 673-674).
[15] His major works devoted to employee participation in corporate governance are books *Self-Government in Industry* from 1917 and *Guild Socialism Restated* from 1920.

form of ownership is in its basics only a modified "collective" form of capitalist private ownership and can be in no case a form of common ownership, a collective ownership in the sense of socialist communalisation. The basic antagonism between the social character of production and private-capitalist privatisation is also present in this so-called collective form of capitalist private ownership. Though capitalist production relations adjusted to the attained level of productive forces development, the exploitation of work by capital still exists and the socio-economic foundation of capitalism rests the same (Korček, 1972: 25).

Apparent gap of several decades between the appearance of industrial democracy and the creation the new E. D. concept, is very well filled by John Dewey and his work. Early at the beginning of the 20th century, he pointed towards the obsolescence of classical liberalism with its rigorous and dogmatic individualism, as well as towards the need of wide application of the democracy, which he "treated as a moral ideal rather than as a descriptive political or legal concept" (Edwards, 2006: 2).[16] The major indications of E. D. in his work include the emphasis of necessity of the cooperative management of productive forces (see Dewey, 2001: 348) or the use of linguistic term "socialized economy" (op. cit.: 377). More clearly is the E. D. resembled in the words of this theoretician of pragmatism in his article *The Ethics of Democracy*, where he highlights that "democracy is not in reality what it proclaims itself to be, as long as it is not equally economic, civil and political... Our civil and political organisations are imperfectly democratic. Because of them, as much as because of the economic relations themselves, is the democracy a necessity in the field of wealth" (op. cit.: 555-556). Timeless seems to be the following claim from the same article, as it has a strong moral sing: "We accept or sometimes we even demand, that the ethical rules are applied to the work sphere, but we see it as an external application. We do not realize that the economic and work life is itself ethical and it is to become a contribution to the realisation of a personality through the formation of higher and thicker among people. These are the basics of the claim that democracy has to become a *working democracy*" (op. cit.: 558; italics: M. S.). From the mentioned it is evident that in Dewey's work some distinguishing features of E. D., which may however not be overestimated. As G. L. Edwards (2006: 15) remarks, Dewey "could do no more than a gesture towards something vaguely resembling economic democracy".

Observing the Second World War years, we find remark-worthy reference of employee participation in the works of Italian theoreticians of the European Federalist Movement. These are the authors of the well-known Ventotene Manifesto (its 1st version is from 1941): Altiero Spinelli and Ernesto Rossi, later joint by Eugenio Colorni. In their socio-political project they also concentrated on the economic issues. Influenced by socialist visions they for example wanted to prevent monopoly companies from being owned by private owners. "In that case the masses of consumers would be subjects of exploitation" (Prando, 2010: 88). They also called for the establishment of massive economic reforms, the consequence of which "would make the working classes own the production facilities necessary to improve their economic conditions and to help them acquire a deeper autonomy in their private life" (op. cit.: 89). According to the Italian theoreticians, these proposed economic measures (represented by agricultural and industrial reform) were to bring the land ownership into the hands of those, who cultivate this land. Considering the theory of E. D., it is important, that they were to "extend the ownership of workers in the areas, which did not belong to the state monopoly, through the form of cooperatives and shareholding of the workers" (ibid.).

Working with the aforementioned theoretical foundations, the E. D. theoreticians of the 70s (cf. Schweickart, 1997: 63) based their own claims of E. D., which is (unlike the industrial democracy) a polyvalent notion and is impossible to be defined (cf. Sartori, 1993: 12). Among the pioneers and coryphaeuses of this then new theory, we may list the neopluralist – Charles E. Lindblom and his work *Politics and Markets: The World's Political-Economic Systems* (1977), where he fiercely "sets up the discussion on questions dealing with government and politics, markets and relations among themselves" (Svensson, 1995: 191). In this work he "pairs up comparative politics and comparative political economy" (ibid.). Of other equally famous theoreticians of E. D. we may list Michael Walzer and his *Spheres of Justice. A Defense of Pluralism and Equality* (1983), Robert A. Dahl: *A Preface to Economic Democracy* (1985), or a British feminist and political theoretician Carole Pateman (*Participation and Democratic Theory*, 1970). We may also mention distinguished Czech economist and a long term resident of the USA Jaroslav Vaněk (*The Participatory Economy: an Evolutionary Hypothesis and a Strategy for Development*, 1971), then Martin Carnoy and Derek Shearer (*Economic Democracy*, 1980), Ronald Mason (*Participatory and Workplace Democracy. A Theoretical Development in Critique of Liberalism*, 1982), David Schweickart (*Capitalism or Worker Control?*, 1980; *Against Capitalism*, 1993; *After Capitalism*, 2002), Michael Poole (*Towards A New Industrial Democracy. Workers Participation in Industry*, 1986), Corey Rosen and Karen M. Young, eds. (*Understanding Employee Ownership*, 1991) or recently David Erdal (*Beyond the Corporation. Humanity Working*, 2011).

### 4.3 Czechoslovak experience of economic democracy

Of the principles defining the concept of E. D. and those described above, it is impossible not to make out, that this concept is in its many features resembling to the ideas and principles of cooperativism.[17] The popularity of cooperatives soared in the times of the 1st Czechoslovak Republic, when its territory comprised about 10, 000 productive and consumer cooperatives (cf. Hrubec, 2011: 15). The basis of cooperativist movement in Bohemia relied since the 19th century on the work of František Cyril Kampelík (1805-1872), doctor, politician and civil activist. He held the initiative of cooperatives, which were named after him – "kampeličky". These were rural loan cooperatives, organized upon the principle of self-help with relatively small capital and unlimited liability of its members (cf. Dado, 1966: 238). Kamepličky "were founded to fight against the effects of rural capitalism evolution" (ibid.), "they provided loans to agriculturers for operational aims and supported their small savings. Besides this, they were helpful when buying economic necessities (...); abundance of savings was stored in their unit centres, which put them through the Agrarian Bank and the Centrocooperative" (op. cit.: 543). After the communist take-over, the kampeličky were reorganized to pawn shops in 1948 and in 1953 they fused the state-organized pawn shops. Similar initiatives, as the one of Kampelík's followers, were organized in approximately the same period in German environment by banker Friedrich Wilhelm Raiffeisen (1818-1888) and economist Franz Hermann Schulze-Delitzsch (1808-1883). They both took notice of the unpleasant situation that the poorest classes of the society faced, thus they promoted the idea of cooperativism. First of the mentioned authors became the founders of rural agricultural pawn shops and loan cooperatives (i. e. raiffeizens), which "aimed to help small producers in agriculture, in a matter of protection from the continually growing pressure of capitalist competition" (Dado, 1966: 543). Shulze-Delitzsch inspired the creation of small-town enterpreneurs' pawn shops mainly in towns, while the members casted a bigger portion of capital (in comparison with rural pawn shops and cooperatives) and only vouched for the maximum amount of their contribution. After the totalitarian disappearance of kampeličky, their expansion was seen in the Czech Republic back in the 90s, when more than 100 newly established

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[16] Dewey was well aware of his idealism, but fervently defended it: "...it is indeed idealism, but I belong among those who believe that the authentic will will never find a solid foundation, while not based on ideals. And I would add that the best verification of any type of society is just the ideal that the society submits to forms of human life, as well as the extent to which this ideal is carried out." (Dewey, 2001: 558).

[17] These principles see e. g. in Martuliak (1995: 11-12). He summarizes them into the so-called "Cooperative Decalogue".

kapeličky flourished. After a short time these cooperative pawn shops started to go bankrupt, in the aftermath of what many citizens lost their life saving. Consequently, many legislative amendments were enacted with the law no. 87/1995 about savings banks and loan cooperatives, in order to prevent a similar situation in the future of Czech Republic. Concurrently in Bohemia an independent Association of cooperative pawn shops operates since 2001 and it unites a number of current consumer and loan cooperatives and cooperative pawn shops. In the territorial scope of Czech Republic and Slovak Republic it is customary to avoid the term "cooperative". There are two reasons: 1) it is correlated to forced nationalization of the 50s (cf. Blaha, 2011: 74, footnote no. 6; on cooperativism in this period see Martuliak, 1995: 134 and following), and 2) it was (in Czechoslovak geographical scope) preferably used in agriculture, which is not up-to-date. It is not possible to claim, that modern cooperatives are based only on agricultural foundations (cf. Blaha, 2011: 74, footnote no. 6). On the contrary, appropriateness of the usage of the term "cooperative" is documented by the UN, which declared the year 2012 to be the International Year of Cooperatives.

The features of E. D. can be also traced in the legislature of Czechoslovak environment of the 20s. The 25th August 1920 marked the enactment of the law no. 144 and the 12th August 1921 the law no. 330, which established employee councils in mining industry (law no. 144) and in other economic sectors (law no. 330). Both laws, as Jan Švejnar (1978: 179) warns, "were similar in nature, the latter being industrially more comprehensive". Mentioned legislative norms offered the possibility of employee council establishment in every company employing at least 30 (in mining industry 20) employees, and which had been operating for at least 6 months. The main tasks of the councils were "to defend and encourage the economic, social and cultural interests of employees" (Svejnar, 1978: 179). Their specific task was to supervise the practical implementation of collective contracts or to check the compliance with security measures. The employee councils assisted at keeping of the employee discipline and presented an advisory organ in case of dismissal. The latter norms also allowed the employee councils (with an exception of mining industry) to send their envoys to the managerial meetings of the company. This position was only advisory, since they did not dispose of a proper voting right. Moreover, the management of the company was not legally forced to take up their suggestions. The work of employee councils was also adjusted by these laws, as the members of these councils were not allowed to gather in working hours. Half of the financial costs of councils′ activities were remunerated by fees of employees and the other half was paid by employers.

Along with the extinction of the 1st CSR, the employee councils perished quite naturally. They saw their renaissance shortly after the war, when institutionalized by the Presidential decree on enterprise and company councils of the 24th October 1945 (law no. 104/1945). This law distinguished the following types of employees′ representation: enterprise council, enterprise trustee, company council and ad hoc body of enterprise representation (§ 1, law no. 104/1945). Enterprise councils were formed in each independent company employing at least 20 employees; an enterprise trustee was elected in every company contracting 3-20 employees (§ 3, art. 1; § 4). Until these bodies were created, "a concerned organ of united trade unions′ organization" was supposed to nominate "ad hoc body of enterprise representation" out of the employees (§ 5). Enterprise councils held according to § 20 of the law no. 104/1945 the competence

1. to defend and encourage economic, social, health and cultural interests of the employees in the enterprise,
2. to monitor whether the economic activity of the enterprise is carried out in accordance with the general economic interest and with the provisions issued on administering,
3. to monitor whether the economic activity of the enterprise is performed in accordance with proper satisfaction of the economic, social, health and cultural

interests of the employees, observing the aim of general economic utility and valid rules,
4. to participate in the administration of the enterprise, providing suggestions and advices with the aim of gaining the highest economic production and efficiency,
5. to interact with the provision of economic and socio-political governance.

The governance of an enterprise (or in the modern language – management) was, according to the cited Act, required to discuss all general issues with the enterprise council in advance. Furthermore, management had to submit the necessary documentation to the enterprise council (excerpts of employment contracts and schedules) and allow it to inspect the wage documentation and make the excerpts (§ 23). In order to make the operations more effective, each enterprise council had the right to establish its own account. The account had to be approved by the union council of an enterprise and its upper limit was specified by government directive. The Act also established the possibility of employee profit sharing. The governance of an enterprise had an obligation (according to § 24, art. 1) to annually provide an enterprise council with the amount corresponding with the economic performance of an enterprise and social needs of their employees - at least 10% of the net profit of an enterprise. Although the council had the opportunity to attend all meetings of enterprise governance bodies, as well as the right to submit its own ideas and suggestions, the management was not obliged to accept them, only to take notice of them (§ 26, art. 2; § 27). As in the case of economic units, the enterprise councils were also founded in the bureaus of public administration. Their operation was regularized in §§ 30-32. In both periods, before and after World War II, enterprise councils had predominantly an advisory role. However the Presidential decree of 1945 vastly increased their importance in the companies, compared to their almost helpless counterparts before this period (cf. Svejnar, 1978: 183).

The following decrees of President Beneš helped to nationalize other segments of the economy. These steps opened up new opportunities to employee's representation. Employees gained mandate for 1/3 of the representation in councils of directors in state enterprises. Fulminant political changes of 1948 radically changed the practice of employee representation. Members of the Revolutionary Trade Union Movement (in Slovak: *Revolučné odborové hnutie*, ROH) founded in 1945, started to gain impact in enterprise councils and sent their representatives to councils of directors. The gradual centralization of state power also determined the impact of ROH, which eventually became the sole representative of employees' interests.

More evident than in the case of cooperatives, traces of E. D. may be spotted in Czechoslovak environment in the thoughts of Czech politician Ladislav Karel Feierabend (1891-1969), who mentions the term itself in his work only two times, whilst he does not go further in its elaboration. First reference can be searched out in his political memoirs[18] and the second one is present in his book *Zemědělské družstevnictví v Československu do roku 1952* (Agricultural cooperativism in Czechoslovakia until 1952).[19] The philosophy of E. D. was also asserted by famous Czech businessman and co-founder of shoe-maker's corporation Tomáš Baťa (1876-1932). He advocated not only existence of self-governing workshops, which formed the skeleton of the entire company, but also the employee profit-sharing. However, his primordial motivation was not driven by any humanist ideals; his main objective was the economic development of the company. On April 11 1924 he said to his employees: "We provide you with a share of the profit, not because we feel the need to give money to the people of the goodness of our hearts. With this step, we follow different aims.

[18] "I have publicly defended at home that our political democracy must be gradually supplemented with economic democracy..." (Feierabend, 1994: 109). The current literature tends refer to E. D. also as a "production democracy" (cf. Adamová et al., 2001: 40), or as a "workplace democracy" (cf. Schweickart, 2002: 128; 1997: 64; Lane, 1985: 624).
[19] "These power (or electrification) cooperatives were the Czech specialty and served as a good example of economic democracy" (Feierabend, 2007: 51).

Using these devices we want to reduce the costs [...] in order to allow workers to earn more. Your previous deficits are caused by the fact that you only ponder on your benefits and don't pay enough attention to whether another worker will be able to continue doing this work without problems. The offered participation in profits is the remedy for this kind of maleficence, as it will awaken your interest in the revenue of a rapid and proficient work of the entire department, combined with utter reduction of costs. [...] By the share-holding participation, we wish to elevate the workers materially, as well as morally. Worker has to understand our business; he has to feel it and grow with it. We desire to make all our workers the shareholders of our factory" (cited in: Fabianková, K. et al., 2009: 144-145).

Considerably more visible than the ideas of L. K. Feierabend and T. Baťa, it is possible to discover the features of E. D. in the works of another theorist, Czech (or Czechoslovak) economist Ota Šik. His concept of the so called company ownership has become "the clearest expression of revisionist tendencies in the theory of socialist social ownership in the late sixties" (Hába, 1975: 112), though in the period of socio-political thaw and at the same time during the "relatively deep structural crisis of the Czechoslovak economy" (Jirásek, 2009: 123). This economic aspect led then-President Antonín Novotný to charge his old friend and a renowned economist at that time, Ota Šik, with the preparation of his own reform. Though it is true that during their face-to-face meeting Novotný "did gather nothing out of his explanation, but the message itself that anyone can offer some way out of the dire economic situation was enough for him to give instruction to D. Kolder, Secretary for Economics, to arrange an assignment for O. Šik by creating a commission for the development of proposals for a new system of governance" (Šulc, 1998: 48). Of course, Šik was apparently not the only one in 60s and 70s, who proponed the idea of company ownership, which was one of the core principles of the proposed economic reform.

However, some adherents of company ownership (including Šik) held various positions interpreting the concept. Some authors set their stepping stone to be the "criticism of bureaucratic centralism and etatism, which led to the requirement of «decentralization» of the social ownership to the company ownership, hand in hand with the workers' self-governance" (ibid.). In the Czechoslovak economy of this period, the idea of company ownership subsumed the effort to counter (at least on a theoretical level) the central, state-planned and controlled production.

One of the major features of company ownership was that a company should be "a direct and autonomous owner of the means of production" (Hába, 1975: 113), and also the fact that "the collective of a company freely uses the means of production, elects its production program and takes the products for its own [...], decides on its allocation and usage. The company represents mainly the interests of the employees collective and it is managed according to it" (ibid.). Out of the brief sketch of the company ownership characteristics, emerges the central role played by workers, in the hands of whom we find the real "political" power of company, as they are the sole owners of the product made by them and they are also the decision-makers on strategic issues of manufacturing. The concept of company ownership, of course, could not find support among then-Marxist economic dogmatists, since according to them, this type of property was "not a social property" and any attempt to change the social ownership in theory or in practice could not "be evaluated differently than as revisionism" (op. cit.: 114). During the period of the so-called normalization (70s and 80s), the attacks against the proponents of this alleged "revisionists" were sharpened, both in theoretical and practical level, as documented in some statements published in the scientific journal *Politická ekonomie* (Political Economy). During the "Prague Spring" this journal paradoxically served merely as a platform for new economic concepts. Among various verbal "scientific" offenses, we may cite for example the following examples: "The efforts to dissolve the social ownership of the means of production and transfer them to the

company level had objectively led to the substitution of inwardness of the (Czechoslovak Communist) Party and working class by the inwardness of individual producers of goods, which in effect resulted in the neutralization of the central regulation of economic processes" (K vývoji..., 1972: 810 ); "Implementation of company ownership could objectively lead to the weakening and then also to the removal of basic advantages of socialism over capitalism" (ibid.); "Right-wing economists argue that while all subjects, i. e. companies, are included in the unified state hierarchy and they are treated as components of the central state power, a relatively independent operation of the economy (which is itself regulated by the market criteria) cannot arise. If businesses act according to the market criteria and create a market economy, which has the ability of self-regulation, then the corporate sector must be separated from the state hierarchy. It is said to go "solo" policy from the center and to provide some space for the market subjects. Functions of society-wide plan are to be minimalized, central government retreats and with it also retreat the advantages of socialism, deriving from the social unification of work guided by plan. Without society-wide planned governance, long-term and significant social interests cannot be realized. Without these the working class could not maintain its power and could not fulfill its historical mission. Right here there is a revision of Marxism-Leninism to its most essential point, because from planned governance, which is one of the constitutional instruments of working class power in the economic sphere, it is stepping back to the scope of pure business and market rationality" (op. cit.: 811). In addition to such "intellectual" condemnation, Šik's reform was as a whole "explicitly interpreted (by the emerging political elites, M. S.) as a political act, which was related to the allegedly intended secession of Czechoslovakia out of the block of the so-called socialist countries" (Jirásek, 2009: 125).[20]

As a result of the unwillingness of the central state authorities, Ota Šik formed the rest of his theoretical work (after 1969)[21] in exile, where he later elaborated his idea that "«all workers of a company must become its co-owners», into the theory of a «third way» of the societal development (which was neither capitalist, nor communist)" (Hába, 1975: 114), or into the theory "of human economic democracy" (see Šik, O.: Socialismus – Teorie a praxe, in: Šik et al., 1990: 14-44). He assumed that the democratic model of economy can "overcome the inadequacies of the "real" socialist systems, as well as capitalist systems" (Šik et al., 1990: 27). According to Šik, the third way was called to "overcome the negative aspects of simply communist, as well as capitalist system" (Šik, O.: Der dritte Weg..., 1972, in: Hába, 1975: 115). As long as practical measures are concerned, the concept of the third way was oriented mainly towards "the conversion of stolen property to the collective ownership of all company workers, i. e. towards modern form of collective ownerships of the means of production" (op. cit.: 115). The transition to the collective ownership, which he called collective capital, should be according to the author "assured by a system of minor, by the law specified, shareholders" (ibid.). Collectively owned companies should be in their mutual relations guided by the principles of free market, without bureaucratic state interventions. On the contrary, "the state should be limited to the issuing of generally valid and basic rules governing economic activity, or it should seeks to promote economic and social purposes by the instruments of economic policy" (Šik et al., 1990: 28). Although Zdeněk Hába admitted that the spirit of this theory was inspired by anarcho-syndicalism (cf. Haba, 1975: 115), the individual features can definitely be considered very close to the modern reflection on the employees' sharing of a company and participation on the decision-making, which have later condensed into the theory of E. D. as we know it today.

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[20] More about the whole economic reform process in former Czechoslovakia can be found in Bobulová (2011), Jirásek (2009); Šulc (1998). Case study concerning implementation of the E. D. in a sector of light industry in Opava (Czech Republic) during years 1945-1948, i. e. before Šik's economic reform, offers Z. Havlíčková (2010) in her impressive Bachelor thesis.
[21] The works are, for instance, *Demokratische und socialistische Plan und Marktwirtschaft*, Zürich, 1971; *Der dritte Weg: Die Marxistisch-Leninistische Theorie Und Die Moderne Industriegesellschaft*, Hamburg, 1972.

It is worthy to mention that the scientific exploration of the concept is in the scope of Central Europe overlooked and it is marginalized by the majority of current theoreticians. Despite this, outside this geographical sphere, especially in the American scientific environment, it has been receiving considerable attention since the 70s. Among major American exponents of the participatory democracy concept, it is worthy to mention the Czech native economists: Jan Švejnar and Jaroslav Vaněk. The latter – Jaroslav Vaněk – was thanks to his advocating of the employee participation idea ostracized by the mainstream scientific community, even despite his previous merits in the field of economics.

## 5. Conclusion

Economic democracy is a quite controversial concept, the proponents of which highlight it as one of the possible alternatives to the current capitalist economic organization, as well as a potential tool to strengthen the political participation of citizens. As it was presented above, it is not only a strict theory that does not have its practical implications. Furthermore, this concept is not the fruit of only recent theoretical debates. Its roots date back approximately to the 18th century. Since this time many philosophical thinkers of different schools, ranging from social utopians to liberals, guild socialists to the current proponents of participatory democracy, have been interested in it. It must be admitted realistically, that genuine economic democracy as described in the paper, could be in majority countries hardly feasible in the foreseeable future. Until then, its proponents should be satisfied rather with small, gradual steps, leading to the empowerment of employees and increasing their involvement in the decision making process in their workplaces. If we accept the argument that the current corporate-capitalist society of Western polyarchies is a participatory society, then it is necessary that it should be "a society, which likes the experiments, society that is able to experiment immediately after the radical reform of the rigid structures generated by private capital and class relationships or of the other power asymmetries" (Kováčik, 2009b: 152). One of the forms of such experiments is the economic democracy. Strong historical and theoretical foundations have been already built. Therefore it remains an open question whether our society will endeavor to build on them.[22]

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# QUALITY AND LEAN MANAGEMENT APROACH IN MAINTENANCE

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Abstract: The article deals with the possibility of utilization of the lean production method, in particular the methods of work measurement, in the frame of rationalization of maintenance. Compendium of methods for measuring and utilizing work of workers in maintenance was created. The article follows advantages and disadvantages of all methods regarding their suitability for optimal run of the workplace and effective utilization of the workers. Application of individual methods to specific company data with the view of verifying the applicability of these methods in practice can be found in the case study. In the final part of the article assumptions and recommendations are introduced for subsequent utilization of methods for determing number of workers in maintenance.

Keywords: indirect labour, lean manufacturing, maintenance, methods time measurement, personal costs, work efficiency.

## 1 INTRODUCTION

The introduction section of this article deals with general characteristics of different methods of time analysis and respective benefits of their use with regard to how this field is addressed in professional literature. There has been long-term lack of interest in researching this scientific field, which caused significant lack of professional literature. Despite this fact, in the enterprises the standardization of overhead work seems to help to shorten the running time of production significantly. For that reason the methodology of standardization should be adapted to specific needs of auxiliary and service works, especially in maintenance. Standard procedures should be replaced by new approaches in the study and work designing, analyses and standardization that comply with the specific conditions in these processes. The main tool for achieving this goal is the selection of an appropriate method of time analysis, which objectively evaluates time consumption of individual work tasks [8].

### 1.1 Methods for Determining Labour Input and Work Structure

The following chapture deals with the compendium of the methods which according to the professional literature objectively evaluates time consumption of individual work tasks in the auxiliary and servicing processes.

Monitored are all activities performed by a worker working on his own, inclusive of measuring their time utilization. The actual recorded data is entered onto an observation sheet. This kind of a working day snapshot comprises the most detailed record of all work activities and an uninterrupted monitoring of working time utilization during a shift. Instant monitoring partly replaces the traditional method of a working day snapshot. Its application is simpler and less time consuming for the observer. The principle of this method based on the probability theory and the theory of random choices lies in the time evaluation of a representative number of randomly selected short periods of time during a work shift. Evaluation of such samples corresponds with the results, providing that both comprehensive monitoring and all data collection are complete [1]. Zonal and Multilateral Monitoring was developed to detect utilization of workers in non-stationary workplaces and combines simultaneous monitoring of work processes in designated zones with the use of suitable assessment software, where individual zones are defined by work operations performed there. Chronometry allows a thorough examination of the operations and time corrections, all without the actual use of a normative base, although its lengthy and laborious use poses a disadvantage [6].

Predetermined time values methods are based on combination of time and motion studies. It divides manual labour into basic movements that are necessary for its completion. To each of such basic movements, a predetermined time value relates, determined by the nature of the basic movement and any

influences that affect its implementation. The original MTM (Motion Time Method) method is for setting indirect labour standards prohibitive because of its extreme labour intensity. Using the MTM method, it takes 8 hours for an analyst to process 1 minute of an operator's labour. Basic MOST (Maynard Operating Sequences Technique) System was developed based on the requirement to measure work faster than when using the MTM System, while maintaining the same accuracy level. Most companies use it in their production systems, but using it for the description of indirect labour is very restrictive due to its limited datacard of predetermined moves [17]. A specific method Maxi MOST created directly for evaluating activities such as handling, transportation of goods on trucks, and bringing materials, i.e. activities connected with auxiliary and service processes in the production. Derived from the method MTM are also UAS (Universal Analysing System) System, system SMA (Standards de Manutention Analytiques) System and system SMB (Standards de Manutention de Basse) System. The UAS System links basic movements together in sequences that enables a rougher breakdown of types of grips, precision of location and length, and is therefore suitable for the description of indirect labour. SMA System and SMB System were developed specifically for measuring time consumption during material handling and in terms of its labour intensity level corresponds to the UAS System. However these methods are being used only in Francophone countries.

The UMS (Universal Maintenance Standards) System can be applied only when standardizing maintenance work on buildings or equipment. The system rests on two basic pillars: the definition of the range of work activities and time comparison of the individual activities [7]. Normative Systems for Work Planning were created in the 1980s at the Institute of Work Planning in Heavy Industry. However, their use is nowadays limited due to their outdated data and their lack of normatives for operations that use electronic systems and other tools associated with the developments of recent years.

### 1.2 Methods for Setting Staff Number Standards

Methods for determining time standards can be divided in accordance with professional literature into two main groups: Analytical Methods and Summary Methods [9]. An analytical method analyses work time, time of generally requisite breaks and time of conditionally requisite breaks. However, the method displays considerable inaccuracies when used in cases where standards are not met or exceeded, and where the amount of items in a batch varies. In the summary methods the time standard is determined by a single time value by means of regressive analysis, statistically, by summary comparison, or through estimates. A significant factor in deciding which suitable normative to select is the repetition of work. Both methods can be used when monitoring work in auxiliary and service processes such as maintenance and material handling. If the occurrence and duration of operations performed by staff is mainly of a random character, then queueing theory can be used for setting standards, which in turn enable the description of the course of the process for a different number of workers. Calculation of the number of workers from the operating standard is then based on the proportion between the number of operated units and the operating staff standard. Capacity planning should be based on a list of tasks that need to be done, on their priorities and on the usable time fund. The following sections describe the methods which can be applied when dealing with this issue.

- Analytical methods for setting staff number standards (Queueing Theory, Standardized Labour Input Method, Idle Time Method);

- Summary methods for setting staff number standards (Regressive Analysis).

The complexity of Queueing Theory rests in establishing an accurate calculation model. In practice two basic undesirable situations occur in service work: operating staff are either overloaded and requirements thus accumulate, or there are not enough requirements on operating staff, resulting in idle time [4]. The staff number standard, i.e. the optimal number of operating staff depends on the ratio between the unit value (costs and profits) of a time applicants spend waiting for operation and unit value of idle time of operating staff. In this situation the economic aspects must be taken into consideration, which include the cost of applicants waiting in the queue and the costs of operating staff waiting (costs of service channels operation).

The use of Regressive Analysis is conditioned by a sufficient amount of input data. When determining the number of staff, this method monitors the dependency between individual aspects of a production process and the number of workers involved in this process [2]. Input data for estimating regressive functions include information on the number of workers linked to a relevant group of machinery and the average size of a batch. The regressive analysis enables the estimation of the value of a certain random variable based on the knowledge of other variables.

The Standardized Labour Input Method is applicable on the condition that the scope of performed work is known and the time standards for all operations are available. This method essentially determines the overall scope of work and compares it with a usable time fund of an individual employee. On the contrary, the Idle Time Method is based on establishing time when workers performing auxiliary and servicing work are not used to their full capacity. Based on the resulting time loss, the number of workers is subsequently reduced to the optimum. The method is particularly demanding in terms of basic data collection and their further evaluation [12].

## 2 OBJECTIVES AND METHODOLOGY

### Classification of the methods

The analyzed methods were divided into two groups; initially into a group of methods determining time usage and structure of work (table 3), and subsequently into a group of methods suitable for determining the number of workers (table 4). According to criteria the individual methods in both groups were then sub-divided into categories A - C in line with their suitability for the use in the plastic-processing industry.

### Conditions for Use of Method for Describing Indirect Labour

Category A          Method suitable without limitations.

Category B          Use of method suitable under certain conditions.

Category C          Use of method for description of given activity unsuitable.

The primary objective of the research in the given field is the selection of a suitable method for determining labour input and work structure. The most suitable method for measuring and analysing time usage that were used and applied to maintenance work is the UMS (Universal Maintenance Standards) System. In this method, the datacard's range of indexes incorporates a large variance from one production cycle to another [15]. The extended datacard offers a wider scope of predetermined times for the use of tools and instruments typical for description of work in maintenance. After compiling normatives in the system UMS, the author of article sees an ideal solution in creating a database system which would enable its users to perform measurements and obtain required data without the need for a deeper understanding of the principles of standardization. In turn, this would allow the group of potential 'evaluators' to be enlarged by people who have been only briefed about this system, which subsequently brings the desired simplifications and speeds up the process of creating indirect labour standards.

The next step was to select and test a group of methods suitable for determining the number of workers in the maintenance department.

## 3 CASE STUDY

All methods were applied to data from a specific company with the view of verifying their applicability in production company conditions. The results clearly show that there is no universal method suitable for standardizing all types of indirect labour.

Basic requirements for maintenance of assets (buildings, machines, equipment, different facilities etc.) include:

1. asset controlling and maintaining in operating and capable (functional) state,

2. prevention of failure occurrence and following fault,

3. operational corrective maintenance,

4. reduction of the environmental impact of machine and equipment operation,

5. operational safety assurance,

6. maintenance of optimum cost structures.

Fulfillment of asset requirements on maintenance and achievement of defined maintenance quality characteristics require to create, introduce, maintain and improve maintenance quality management system as an instrument of effective asset maintenance management in organizations [5].

### 3.1 Application of the Queueing Theory

The aim of research activity was to find out whether it is possible to set with queueing theory optimal number of number of workers in maintenance for required working area. Further it approached to check of current capacity utilization of machines according to the costs. Total costs were calculated and according to equation (1) was found optimal number of operating staff [3].

Optimal solution with lowest costs for the company was found in the minimum of the function (1).

$$Nc(S) = \frac{\lambda}{\mu}(C - C_{SV}) + C_{SV}S + \frac{x\lambda C_w}{S\mu(S\mu - \lambda)} \qquad (1)$$

$\lambda$          arrival rate
$\mu$          service rate
$S$          number of service channels
$C$          cost of service capacity (cost per server)
$Cw$          waiting cost
$Csv$          downtime cost
$Nc$          total costs
$x$          total number of requests per hour

$$\rho = \frac{\lambda}{S\mu} \qquad (2)$$

$\lambda$ = 16,56 requests/hour
$\mu$ = 7,45 requests/hour
$\rho$ - intensity of output

**Tab. 1: Optimal selection of number of workers in maintenance. Source: author´s own**

| Number of workers | 3 | 4 | 5 | 6 |
|---|---|---|---|---|
| Lp | 0,895 | 0,247 | 0,061 | 0,008 |
| Ln | 0,127 | 0,041 | 0,009 | 0,002 |
| r.Crv [Kč/h] | 885 | 1180 | 1475 | 1770 |
| Lp Cm[Kč/h] | 1121,43 | 309,49 | 76,43 | 10,02 |
| Ln Cm[Kč/h] | 159,13 | 51,37 | 11,28 | 2,51 |
| C´ [Kč/h] | 2165,56 | 1540,86 | 1562,71 | 1782,53 |

Note.: Lp – average length of the priority adjustments per hour, Ln - average length of the priority adjustments per hour, (calculation by SW STORM)

**3.2 Application of Standardized Labour Input Method**

Methodology of the Standardized Labour Input Method is quoted in Kroupa (1985). It consists of following parts:
• Drawing up a list of work tasks that are to be completed within a given period;
• Determining labour input of individual operations in man-hours;
• Determining the overall labour intensity in man-hours, including the degree of fulfilment of standards;
• Determining usable time fund of an individual worker, or respectively the volume of idle time that cannot be eliminated;
• Determining the necessary number of workers according to the equation (3).

$$P = \frac{Q}{k_n F_c} \qquad (3)$$

$P$ - number of workers

$Q$ - overall labour intensity in standard-hours [Nh]
$k_n$ - coefficient of fulfilment of standards

$F_c$ - usable time fund in hours

Standard work shift fragments are according to equation (4).

$$T = t_{A1} + t_{B1} + t_{C1} + t_2 + t_3 + t_D + t_E + t_F \qquad (4)$$

$t_{A1}$ - work time for the unit

$t_{B1}$ - work time for the batch

$t_{C1}$ - shift work time

$t_2$ - time generally requisite breaks

$t_3$ - conditional requisite breaks

$t_D$ - individual lost time

$t_E$ - lost time due to organizational problems

$t_F$ - more superior lost

The current situation in the factory: 21 machines are being adjusted by 4 workers (2 specialist for reparations, 2 workers for prevention of failure occurrence (TPM). Time consumption for workers in maintenance was according to the evidence system settled:

Overall labour intensity in standard-hours = 26490 Nh/year.

Effective time fund in hours (of the worker) = 6900 Nh/year (84 % utilization of the worker)

Usable time fund in hours (of the worker) = 7848 Nh/year

$$P_1 = \frac{2 \times 6900}{7848}$$

$P_1$ = 1,75 (rounded 2 workers)

**3.3 Application of Regressive Analysis**

On the example presented in the table 2 can be seen the dependency between individual aspects of a production process (labour intensity in standard-hours [Nh] and production volume) and the number of workers involved in this process. The regressive analysis enables the estimation of the value of a certain random variable based on the knowledge of other variables. In the table 2 can be seen difference between predicted standard and number of currently employed workers. This method is valuable especially within preparation of the predictive model for capacity planning. For creating of regressive function can be used any statistical software or MS Excel applications.

According to data gained within the research – dependent variable Y (required number of working shifts) and independent variables (x), see list of independent variables below:

- number of machines ($x_1$),

- average length of reparations ($x_2$),

- complexity of the reparation ($x_3$),

- ability to fulfill the production plan ($x_4$).

The aim is to set a regressive function in order to create a model for determining the optimal number of workers in maintenance:

$$Y = e^{-10,083} . x_1^{0,0441} . x_3^{0,051}$$

**Tab. 2 - Determining the optimal number of workers by regressive function. Source: author´s own**

| Working shifts required | Number of machines $x_1$ | average lenght of reparation $x_2$ | Regressive estimation | Difference betw. standard and estimation |
|---|---|---|---|---|
| 4 | 17 | 65 | 4,061 | 0,061 |
| 4,5 | 33 | 64 | 5,023 | 0,523 |
| 5 | 36 | 66 | 5,304 | 0,304 |
| 5,5 | 33 | 80 | 5,759 | 0,259 |
| 7,4 | 40 | 89 | 6,614 | 0,786 |
| 4,5 | 40 | 45 | 4,59 | 0,09 |
| 5 | 35 | 50 | 4,505 | 0,495 |
| 6 | 35 | 83 | 6,023 | 0,023 |
| 5,5 | 39 | 75 | 5,907 | 0,407 |
| 6 | 34 | 82 | 5,914 | 0,086 |

**3.4 Application of Idle Time Method**

The current situation in the factory: 21 machines are being adjusted by 4 workers (2 specialists for reparations, 2 workers for prevention of failure occurrence (TPM). Time consumption for workers in maintenance was according to the evidence system settled:

Overall labour intensity in standard-hours = 27 600 Nh/year

Effective time fund in hours (of the worker) = 6 900 Nh/year

Usable time fund in hours (of the worker) = 7 848 Nh/year

Utilization of the worker:

T1 working time = 88 %

T2 + Td = time requisite breaks + individual lost time = 7 %

Te = lost time due to organizational problems = 5 %

## 4 CONCLUSION

The analyzed methods were divided into two groups; initially into a group of methods determining time usage and structure of work (table 3), and subsequently into a group of methods suitable for determining the number of workers (table 4). According to criteria the individual methods in both groups were then sub-divided into categories A-C in line with their suitability for the use in the plastic-processing industry.

**Tab. 3 - Overview of the methods for determining the number of workers in maintenance in the plastic-processing industry. Source: author´s own**

| Method | Suitability for use in plastic-processing industry | Reason |
|---|---|---|
| Standardized Labour Intensity Method | YES | Providing that database of normative is created. |
| Queueing Theory | YES | Description of randomly arising requirements. |
| Regressive Analysis | Partially | With sufficient volume of data, comparable with actual situation. |
| Idle Time Method | YES | Laborious in terms of data collection, suitable also for improvements. |

**Tab. 4 - Overview of the methods for measuring and analysing time usage that were used and applied to maintenance in the plastic-processing industry. Source: author´s own**

| Method | Suitability of Method | Categ. | Justification of suitability/unsuitability of use |
|---|---|---|---|
| Working DaySnapshot | YES | A | Particularly suitable for collection ofprimary data. |
| Instant Monitoring | YES | B | Suitable in uninterrupted flow operations. |
| Zonal/Multilateral Monitoring | YES | A | Suitable for material supply and warehouse work. |
| Continuous Chronometry | YES | A | Suitable, providing that monitored tasks occur in regular sequence. |
| Selective Chronometry | YES | B | Partially suitable, for irregular operations. |
| Instant Measuring | YES | B | Suitable for irregularly repeating operations, for small production batches. |
| MTM | NO | C | Unsuitable, disproportionate labour intensity of data processing. |
| Basic MOST | NO | C | Unsuitable, disproportionate labour intensity of data processing. |
| Maxi MOST | NO | C | Unsuitable, does not allow description of necessary operations. |
| UAS | YES | A | Suitable, using movement cycles. |
| UMS | YES | A | Absolutely Suitable, provide description of all activitvies. |

| SMA | NO | C | Unsuitable, limited |
|---|---|---|---|
| SMB | NO | C | Unsuitable, focused on descreption of data maintainance. |
| Systems of Normatives | ANO | B | Applicable method, but data not updated. |

The main objective of the article was to analyse various methods for standardization of indirect labour and formulation of conditions for their use in the plastic-processing industry. Methods were firstly applied to a selected group of workers in maintenance. Suitable methods were then selected based on the results, which were recommended for the description of these activities in the plastic-processing industry. System UMS was selected as the most suitable method. This system offers a wider scope of predetermined times for the use of tools, instruments in maintenance. Secondly, the established values were used with the purpose of determining which of these methods are appropriate for determining the optimal number of workers needed for executing a given activity. It is not possible to determine a universal method for setting labour standards in logistics on the bases of the completed analysis. Maintenance much like other overhead activities, is affected by time variability and fluctuation of workload. As a result from this research, the methods listed in the tables 3 and 4 are possible to select depending on specific conditions and on variation and repetition of performed work. Despite this fact it is possible to predict that selected methods should have broader applications for planning indirect labour in the medium-sized enterprises in the car-manufacturing industry specializing in plastic components production. The next step of the research will be selection of the suitable methods for standardization of other indirect labour, formulation of conditions for their use in practice and subsequent proposal and creation of a model for indirect labour capacity planning.

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**Primary Paper Section:** A

**Secondary Paper Section:** AE

# LOCAL GOVERNMENT DEFICIT IN POLAND UNDER CYCLICAL ECONOMIC FLUCTUATIONS

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Abstract: Cyclical fluctuations in GDP growth have a significant impact on the vast majority of economic indicators. Past surveys showed that economic fluctuations are reflected in the amount of revenue generated by local governments. The present article discusses the problem of economic impact of cyclical fluctuations on the results of local government budgets.

Keywords: deficit, budget, cyclical economic fluctuations

## 1 Introduction

Cyclical economic fluctuations exert a considerable impact on the majority of phenomena occurring in modern economy, what can be proved by the swings in major macroeconomic indicators. The changeability of GDP dynamics is presented in Chart 1.

**Chart 1. GDP dynamics (year on year) in fixed prices between 1997 and 2011**
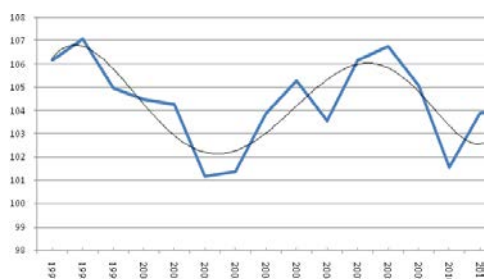


Source: own work based on Central Statistical Office's data www.stat.gov.pl

Changes in value of respective macroeconomic indicators resulting from cyclical business fluctuations have an impact on budgets of local government units with respect to both revenue and expenditure what, in turn, affects the budgetary deficit[1]. As far as budgetary revenues of local government units are concerned, we can observe a serious decrease in the growth dynamics. It is due to the fact that the Law on Revenues of Local Government Units, in force since 2004[2], brought about the fall in proportion of external transfers in financing local government units' operations[3]. The external transfers proved to be less sensitive towards cyclical fluctuations than own source revenues[4]. The highest sensitivity towards business fluctuations among own source revenues was detected in Personal and Corporate Income Taxes (PIT and CIT). These are the kinds of revenues over which local government authorities have practically no influence[5]. The current system of financing local government units in Poland is seriously handicapped by its close dependence on business cycles and by the lack of safeguards against drops in the revenue level[6]. The deficits which accumulate in consecutive years contribute to the public debt of local government units, in this way economic fluctuations are also reflected in the amount of this debt.

Economic indexes show three different kinds of dependence on the dynamics of GDP changes: pro-cyclicality, anti-cyclicality and acyclicality. The majority of primary macroeconomic measures[7] can be classified as pro-cyclical with considerably high correlation with GDP[8]. The anti-cyclical measures concern, among others, unemployment rate and added value in agriculture[9]. Not only can we speak of directional correlation but also about the shift in time in the course of value of macroeconomic measures in relation to GDP dynamics and about diversified amplitude of fluctuations towards GDP dynamics. An additional factor influencing the sum of liabilities of local government units is surprisingly high pro-cyclicality of public consumption[10].

Apart from fluctuations in revenues and expenditure which result from cyclical economic fluctuations, budgets of local government units are subject to many other factors which determine their balance. The most important ones are: firstly, the change in the method of setting the maximum level of budgetary deficit, this change was brought about by the amendment to the Act on Public Finance[11], and secondly, increased demand for loan funds for projects co-financed by EU within Financial Perspective 2007-2013[12]. Another factor which may affect the results of the local government sector is the policy of central administration which imposes on local governments execution of new tasks and projects but without ensuring appropriate financial resources for their realization[13].

There are many different factors which are sensitive towards business fluctuations and which influence the sum of liabilities of local government units, that it is impossible to discuss them all. That is why, the research presented in this article only focuses on the analysis of changes in the sum of liabilities of local government units caused by economic fluctuations.

## 2 Results of budgets of local governments units

A positive difference between public revenue and public expenditure, set for a settlement period, constitutes the surplus of the public finance sector, and a negative difference is the deficit of public finance sector[14]. These concepts may, of course, be aggregated to different levels. They may be divided into deficit/surplus of public sector, local government sector, insurance sector, or further down, results of gminas (communes), poviats (counties) and voivodeships. The results of particular units of public finance sector are shown in Chart2.

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[1] See also: P. Mrowiec, Założenia do projektu budżetu Gminy Czechowice –Dziedzice na 2012 rok w kontekście deficytu sektora finansów publicznych oraz innych uwarunkowań, Zeszyty Naukowe 4/2011, Published by Bielsko-Biała School of Finance and Law, Bielsko –Biała 2011.
[2] Act of 13 November 2003, on Revenues of Local Government Units, Journal of Laws 2003, No 203, item 1966
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[4] More in: Żabka A., Wpływ cyklicznych wahań koniunktury na dochody JST [w:] Polityka rozwoju regionu. Koncepcja – procedury administracyjne – Finansowanie Malik K. [red.], Published by: Wydawnictwo Naukowe „Akapit", Opole 2010,
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[6] Ibidem s. 365

[7] These include: private consumption, governmental expenditure, import, GDP deflator, CPI, employment rate, real M3, 3M WIBOR and real 3M WIBOR, investments, export, industrial processing, M3, unemployment rate based on: Skrzypczyński P., Metody spektralne w analizie cyklu koniunkturalnego gospodarki polskiej, Materiały i Studia, zeszyt nr 252, Published by: NBP, Warsaw 2010, p.158 and further on
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[9] Ibidem p.55
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[12] Cf. Widera A., Jeśli samorząd bierze kredyt, to raczej przez spółkę, www.portalsamorzadowy.pl z dnia 12.03.2012; Prospects of Local Government Sector in Poland in 2012 Fitch Ratings report (in Polish); December 2012; www.fitchratings.com
[13] Perspektywy sektora… op. cit.2
[14] Act on Public Finance, Journal of Laws 2009 no 157 item 1240; article 7 point 1

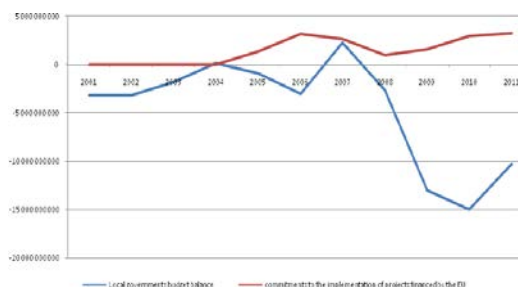**Chart 2. The result of state budget and local government units in 2001-2011**
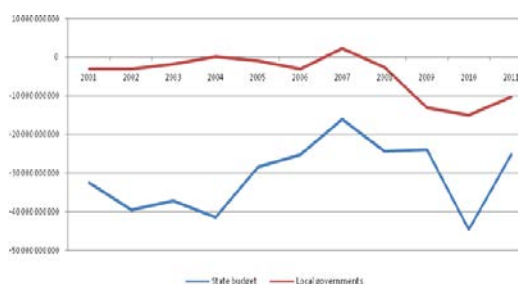


Source: own work based on Government Budget Reports (published in Polish): Information on Local Government Budget Execution, Warsaw 2002-2012 (www.mf.gov.pl) and data from Central Statistical Office (www.stat.gov.pl)

The flow of the chart which pictures the level of state budget deficit shows a visible convergence with the concurrent business cycle in Poland. Together with an economic upturn of 2004, the budget deficit was falling down systematically. When the Polish economy entered into the recession phase, the deficit grew bigger year by year. The reduction in the state deficit in 2011 should however, be attributed to the fear of exceeding the 55% threshold of relation between public debt and GDP, rather than to factors related to a given economic cycle.

As far as local government deficit is concerned, until 2007 there was no convergence with the concurrent business cycle. After 2007 the deficit increased considerably and the question was why? If the increase in the deficit was caused by slower economy, why the changing business cycles had not affected the budgets of local government units in the previous years? The reason may be the change in the structure of local government units' revenue, initiated by passing of the act on local government revenues. This act raised the proportion of own source revenues in the structure of budgets of local government units. Own source revenues seem to be more sensitive towards economic fluctuations than external transfers which flow into budgets of local government units[15].

Another reason may be increased demand for financial resources to cover local governments' own contributions of ventures co-financed by EU programmes. The relation of results of budgets of local government units to liabilities incurred to implement projects and ventures financed in part by EU funds is presented in Chart 3.

**Chart 3. Relation of results of budgets of local government units to liabilities incurred to implement projects and ventures financed in part by EU funds for the period of 2001-2012**



Source: own work based on Government Budget Reports (published in Polish): Information on Local Government Budget Execution, Warsaw 2002-2012, www.mf.gov.pl

The visibly higher growth dynamics of liabilities for financing EU projects and programmes can be seen in the following periods: 2004-2006 and 2008-2011. In both periods the deficit of local government units' rose, however in 2008-2011 this rise was radically inadequate to the rise in liabilities for financing projects and programmes co-financed by EU funds. This leads to the conclusion, that the time convergence of rise in the deficit

and economic slowdown was not coincidental. This proves that economic fluctuations directly affect the results of local government units' budgets. This phenomenon remained unnoticed until 2007 because the sources of income of local government units were different before and after that year. The new Act on Revenues of Local Government Units[16], increased the proportion of own source revenues in budgets of local government units, and this particularly concerns PIT and CIT taxes. These two sources are particularly susceptible towards economic fluctuations because tax revenues of the national budget show high positive correlation with GDP in current prices as well as visible positive correlation with wage level in corporate sector and gross average monthly wage[17].

**3 Budget results of voivodeships**

The characteristic feature of voivodeships' budgets is high proportion of own source revenues in the whole structure of the budget. In contrast to the budget structure of gminas (communes), the structure of voivodeships' budget is characterized by very low diversification of income sources. The predominant constituent in the own sources portfolio are revenues from income tax from legal entities, This source, unfortunately, shows great sensitivity towards business fluctuations[18].
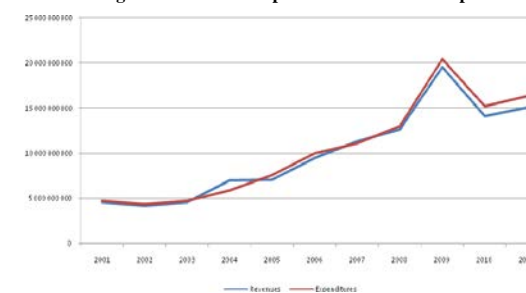
**Chart 4. Budget results of voivodeships 2001-2011**
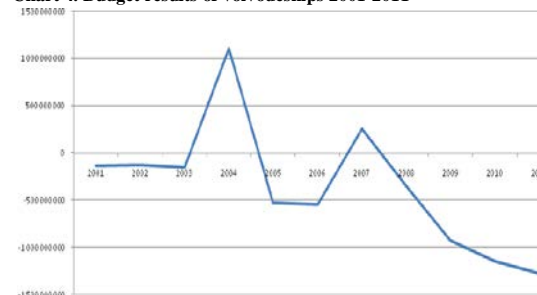


Source: own work based on Government Budget Reports (In Polish): Information on Local Government Budget Execution, Warsaw 2002-2012 (www.mf.gov.pl)

The analysis of budget results of voivodeships lets us assume that the strong response to cyclical economic fluctuations occurred between 2008 and 2011. In this period the drop in GDP growth dynamics is clearly visible which, in turn, is reflected in the value of voivodeships' budgets. In 2008 the increased expenditure of voivodeships (Chart 7) was satisfied thanks to higher level of EU grants for local government units in this period[19]. Budget revenues and expenditure of voivodeships are presented in Chart 5.

**Chart 5. Budget revenues and expenditure of voivodeships 2001-2011**



Source: own work based on Government Budget Reports (published in Polish): Information on Local Government Budget Execution, Warsaw 2002-2012 (www.mf.gov.pl)

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[15] Cf. Żabka A., Wpływ cyklicznych wahań koniunktury… op. cit. p.209

[16] Act of 13 November 2003, on Incomes of Local Self-Government Units, Journal of Laws 2003, No 203, item 1966. This act replaced a previous act on financing gminas (communes).
[17] Cf. Owsiak S., Planowanie budżetowe a alokacja zasobów, PWE, Warsaw 2008, p. 137
[18] Cf. Żabka A., Wpływ cyklicznych wahań koniunktury… op. cit. p. 221
[19] Żabka A., Wpływ cyklicznych wahań koniunktury… op. cit. p.207

In 2004 there was a considerable budget surplus which is also visible in Chart 6. Starting from 2009 we can observe a certain imbalance between revenues and expenditures in the budgets of voivodeships. This imbalance is also visible in Chart 5 which shows results of voivodeships. We can assume then, that budget results of voivodeships are sensitive towards cyclical business fluctuations, especially after 2008.

**4 Budget results of poviats (counties)**

Differentiation of revenue sources of respective local government units causes their different sensitivity towards cyclical business fluctuations[20]. We should therefore examine the correlation of current economic phase with the deficit in particular local government units. The lowest sensitivity can be detected in the poviats' budgets, because of the highest proportion of external transfers in their revenues. Chart 6 presents the results of budgets of poviats (counties) in the period of 2001-2011.

**Chart 6. Budget results of poviats (counties)  2001-2011**
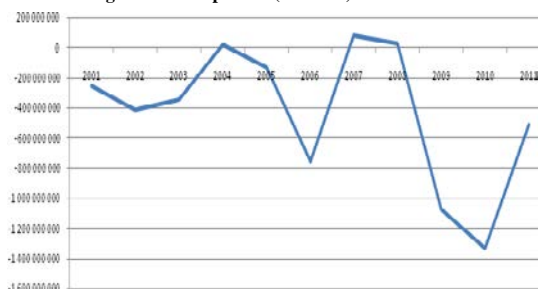


Source: own work based on Government Budget Reports (published in Polish): Information on Local Government Budget Execution, Warsaw 2002-2012 (www.mf.gov.pl)

The budget deficit on poviat level shows response towards cyclical business fluctuations. The first, smoother part of the line in  the trend corresponds with the line for GDP dynamics (see Chart 1). The considerable rise of budget deficit in 2006 is compatible with the fluctuation of GDP growth dynamics in this year (see Chart 1). The reason for this is fall of the revenues dynamics between 2004 and 2006, which can be clearly visible in Chart 7.

**Chart 7. Revenues and expenditure dynamics (year on year) of poviats (counties) budgets 2001-2011**
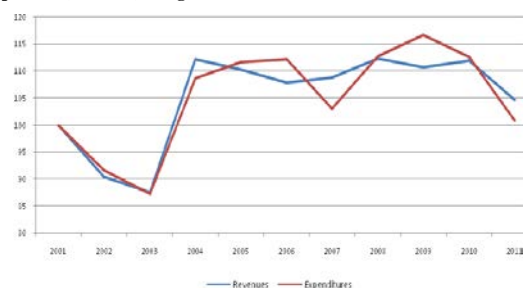


Source: own work based on Government Budget Reports (published in Polish): Information on Local Government Budget Execution, Warsaw 2002-2012 (www.mf.gov.pl)

The analysis of data presented in the chart proves that the main cause of budgetary imbalance which rises together with deepening economic downturn, is the rise in expenditure. The dynamics of expenditure growth, especially in the period of 2007-2009 were higher than the dynamics of revenue growth. A considerable decrease of expenditure dynamics in 2010 and 2011 may have at least three reasons:
- the fall in GDP growth dynamics,
- the national policy on regulating the level of public debt resulting from announcement of the relation of Public National Debt to GDP on the level close to 55%,

[20] Cf. Żabka A., Wpływ cyklicznych wahań koniunktury… op. cit. p. 224

- development of new regulations on permissible budget deficit level of local government units, which will enter into force in 2014.

Thus, it should be clearly stated that budget results of poviats (counties) are highly sensitive towards business fluctuations.

**5 Budget results of gminas (communes)**

The basic units of local government are gminas (communes)[21]. Gminas enjoy the widest scope of competences for delivering public services on local level. The extent to which these services are rendered is determined by gminas' ability to pool revenues. The legislator provided gminas with a number of budget revenue sources. Wide scope of tasks together with wide spectrum of revenue sources at gminas' disposal makes gminas the most interesting subject of this research.
The budget results of gminas (communes) are presented in Chart 8.

**Chart  8. Budget results of gminas (communes) 2001-2011**
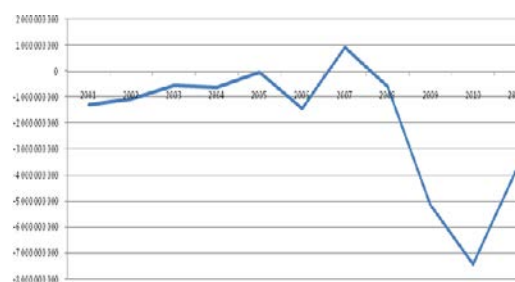


Source: own work based on Government Budget Reports (in Polish): Information on Local Government Budget Execution, Warsaw 2002-2012 (www.mf.gov.pl)

In 2004, when the new Act on Revenues of Local Government Units came into force, the proportion of own source revenues in the structure of gminas' budget was increased. Since that we can observe higher sensitivity of gminas' budget results towards cyclical economic fluctuations. The budgetary surplus is explicitly outlined in the peak year of economic upturn and then follows the rise in the budgetary deficit of gminas brought about by the changed economic cycle. The reduction in the deficit which occurred in 2010 may be attributed to the already mentioned premises: the fall in GDP growth dynamics, the national policy on regulating the level of public debt resulting from announcement of the relation of Public National Debt to GDP on the level close to 55%  as well as development of new regulations on permissible budget deficit level of local government units, which will enter into force in 2014. Any doubts concerning the reasons for the deficit reduction between 2010 and 2011 may be resolved by the   analysis of relations between revenues and expenditures conducted in Chart 9.

**Chart  9. Dynamics (year on year) of revenues and expenditures of gminas (communes) in 2001-2011**
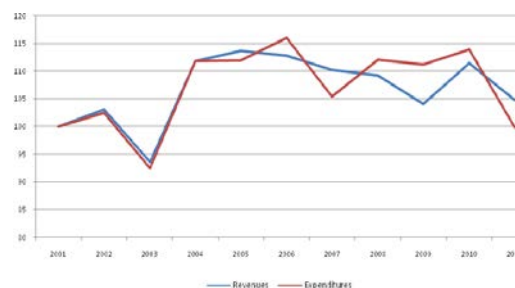


Source: own work based on Government Budget Reports (published in Polish): Information on Local Government Budget Execution, Warsaw 2002-2012 (www.mf.gov.pl)

The reason for a smaller budget deficit in 2011 was a major fall in the expenditure growth dynamics. The years 2005-2009 saw

[21] Constitution of Poland of 2 April 1997, article 164, point1

a visible slowdown of revenues growth dynamics. The largest slowdown of revenues dynamics was noted down in 2011. In the same year even greater fall was observed on the side of expenditure dynamics what caused a considerable reduction of the deficit. A different situation took place in 2008 – 2009. In 2008 a slight fall in the revenues dynamics was accompanied by a major increase in the expenditure dynamics. In 2009, while the level of the expenditure growth dynamics remained stable, the revenues dynamics fell considerably. Both situations brought about the increase in the budgetary deficit seen in Chart 9.

When we consider the situation of gminas (communes) we need to take into account that gminas constitute the most numerous group in the structure of Polish local government and that each gmina may have a different nature and character. The next part of this article presents an analysis of the situation of municipalities (urban gminas) and rural communes (rural gminas) The budget results of urban and rural gminas are presented in Chart 10.

**Chart 10. Budget results of municipalities and rural communes 2001-2011**
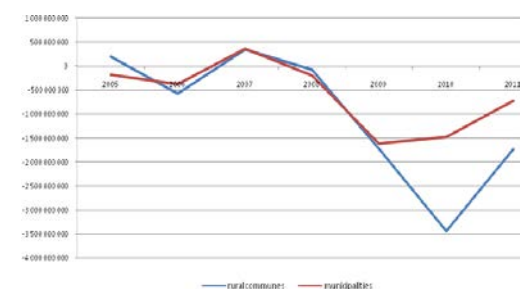


Source: own work based on Government Budget Reports (published in Polish): Information on Local Government Budget Execution, Warsaw 2002-2012 (www.mf.gov.pl)

Worsening economic situation exerts a much bigger impact on rural communes. We must also bear in mind that there are much more rural gminas in Poland than urban ones (what until 2009 did not find reflection in the amount of budget deficit). Thus the dynamics of changes in budget deficit in rural gminas are much higher than in case of municipalities. There is also another phenomenon of delayed reaction towards change in the relation of revenues to expenditure. Both phenomena may be derivatives of the structures of rural and urban budgets. Rural gminas rely more on external transfers of financial resources into their budgets, and this kind of revenue is less sensitive towards economic fluctuations. Own source revenues which are the basis of urban budgets, and especially the revenues from PIT, are much more sensitive towards business fluctuations[22], so the authorities of urban gminas are forced to instantly react to changing economic situation. Another factor which may help explain the late reaction of rural gminas is the way of setting the basic amount of the compensatory part of the general subvention for local government units. The amount of the compensatory part is determined on the basis of budgetary reports from the year preceding the base year[23], so it depends on the situation of the gmina as it was two years before. In case of 2010 the basis for the calculation of the subvention were indicators from 2008. Back then these indicators were quite high which means relatively smaller transfers from this source. Moreover, bad demographic situation influenced the sums of educational part of general subvention, what in many cases meant the necessity to finance education from own resources.

**6 Conclusions**

The conducted analysis clearly shows that cyclical economic fluctuations have a direct impact on budgets of local government units. The slowing GDP dynamics was reflected in the budget deficit on each level of local government.

The articles also proves wrong the thesis that bigger deficit of local government units budget results from their incurring liabilities to cover own contributions for ventures co-financed by EU funds. Such liabilities did not increase in the period when the budget results deteriorated. What's more, it must be said that during the period when the deficit was growing, all ventures realized with contributions from EU funds were in the final phase of realization, and the liabilities to finance them had been incurred in previous periods.

The cyclical business fluctuations affect budgets of local government units in many different ways. The factor which determins the scope of this influence is the structure of revenues. The budgets of gminas (communes) which consist mainly of own source revenues, suffered much more when GDP dynamics fell down, than budgets of poviats (counties) and voivodeships.

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2. Act on Incomes of Local Self-Government Units (Journal of Laws 2003, No203, item 1966)
3. Act on Public Finance (Journal of Laws 2009 no 157, item 1240)

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**Primary Paper Section:** A

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[22] Cf. Żabka A., Wpływ cyklicznych wahań koniunktury… op. cit. p. 209
[23] Act of 13 November 2003, on Incomes of Local Self-Government Units, Journal of Laws 2003, No 203, item 1966, article 20 point 4

# THE INFLUENCE OF THE ECONOMIC CRISIS ON THE STATE OF PUBLIC FINANCES IN THE COUNTRIES OF THE VISEGRAD GROUP

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Abstract: The paper analyzes the relation between the economic crisis, budget deficit, public debt and the fiscal policy. The current economic crisis occurred in the conditions of a high level of public debt in the majority of the developed countries, which on one hand makes it impossible to use expansive fiscal policy and, on the other hand threatens the solvency of some of the countries. In the first part of the paper a theoretical characteristics of the influence of the economic crisis on the condition of public finances is presented. In the second part the statistical analysis of the economic growth, budget deficit and public debt of the countries of the Visegrad Group was conducted. Statistical data confirm the thesis that the economic crisis caused the worsening of the condition of public finances in the countries that belong to the EU.

Keywords: economic growth, budget deficit, public debt, economic crisis, Visegrad Group.

## 1 Introduction

The condition of the public finances is, to a dominant degree, dependent on the condition of the business cycle. The recovery of the cycle is accompanied by the decrease of budget deficit or even achieving a budget surplus, while the economic crisis is the cause of complete opposite phenomena. The budget deficit can become deeper in the conditions of the economic crisis if the country takes expansive fiscal policy aimed at rejuvenation of the business cycle. The experiences of the current economic crisis indicate that such actions are possible only in the conditions of a relatively low level of debt of the country. Some of the developed countries, because of the excessive public debt are forced to conduct the restrictive fiscal policy which contributes to the deepening of the economic crisis. The objective of the paper is to check whether such situation also occurs in the countries of the Visegrad Group.

The thesis accepted for verification is the statement that the economic crisis caused the worsening of the state of public finances in the countries that belong to the European Union, while in case of the countries of the Visegrad Group this worsening was not as deep as to threaten them with insolvency.
In order to verify the thesis above the analysis of statistical data published by Eurostat was conducted, concerning the business cycle, public debt and budget deficit in the countries of the Visegrad Group in years 2002-2011.

## 2 Economic cycle and the condition of public finances

Business cycle fluctuations are an inseparable element of the market economy. From the long-term perspective the trend, around which the fluctuations of business cycle occur ,is rising as the stage of the high dynamics of growth is usually longer than the period of the decline of the level of economic activity. From the short-term perspective, business cycle fluctuations cause the destabilization of the economy, nervous reactions from the investors, significant fluctuations of the unemployment level and therefore, also the fluctuations of the level of living conditions for citizens, causing their dissatisfaction. Because of it, the country may try to restrict the fluctuations of the level of economic activity, deciding to use the stabilization policy (Barczyk *et al.*, 2006). The stabilization policy is based on two basic tools – fiscal and monetary policy (Nellis and Parker, 2006).

In the theory of economics it is still disputed whether and to what extent the country has to interfere in cases when the market mechanism fails as well as to what extent such interference is successful (Snowdon *et al.*, 1998). Economic decision-makers, by deciding about the way of conducting economic policy, are choosing between the laissez-faire ideas (represented by the neoclassical approach in the theory of economics) and national interventionism or etatism (which is referred to by the neo-keynes approach). Those approaches in different ways describe the functioning of economy, in relation to which they estimate the effectiveness of the interventions of the government on real values in the economy in different ways. Neoclassical economists prefer stable, passive rules of conducting the economic policy (constant increase of the supply of money reflecting the long-term pace of economic growth and budget balance), as according to their opinions, the discretionary actions cause disturbances in the functioning of the market mechanism, making it difficult for the economy to return to the equilibrium. The neo-keynes economists on the other hand, prefer the active (discretionary) economic policy, adapted to the current economic situation, believing that relying on stable and passive rules of economic policy lengthens the period of economy functioning in the condition of less than full use of production capabilities as well as in the high level of involuntary unemployment (Wojtyna, 1998).

The opinions of those approaches concerning the use of budget deficit as a stabilizing function are also different. The neoclassical approach is in favor of the policy of budget equilibrium, assuming that it is impossible to stimulate the business cycle by using the active fiscal policy. Budget deficit brings a number of negative economic effects, such as: influencing the rate of inflation and the interest rate, causes the resources to be 'pushed out' of the private sector of the economy (which in the opinions of neoclassical economists is more effective than the public sector), causes the increase of public debt and the costs of servicing it, which in result leads to passing the burden of the debt to future generations (Fletcher, 1989). Conducting the policy of a permanent budget deficit may effect in the excessive debt of the country, threatening its solvency. If the financial markets believe that a given country may not be solvent it will be forced to conduct the restrictive fiscal policy regardless of the state of the business cycle.

For the neo-keynes approach, budget deficit is a tool of supplementing the global demand, influencing in a positive way the rise of the national income (Bougrine, 2004). The neo-keynes economists disagree with the aforementioned negative effects of budget deficit. In their opinion if budget deficit is financed from the issuance of governmental bonds, it does not influence the rise of inflation as the supply of money in the economy does not change. The weakening of the economic cycle stems from the enterprises refraining from investments, in such situation the governmental expenditures supplement but do not replace private expenditures (Owsiak, 2002). In similar fashion, the public sector does not compete with the private sector for loan funds (it does not increase the interest rate). The state loan funds which are not intended for the private sector either due to the lack of interest from its side (in the conditions of high risk relating to investments) or due to the restriction of the pool of means for credits for the private sector from the banking system (because of the loss in credit credibility). While it is true that budget deficit translates into the rise of the debt of the country, but if it results in the improvement of the business cycle, paying the debt back will not be a great burden for the economy.

The neo-keynes approach opposes the suggestion of the policy of budget equilibrium proposed by the neoclassical economists. The concepts of using budget deficit for stimulating the demand suggested by the neo-keynes economists are: the concept of systematic deficit (according to it the budget deficit can occur continuously as it is a beneficial phenomenon) and the concept of cyclic budgets (the peak of the business cycle should be used in order to achieve budget surplus which will be used to finance budget deficits generated in the period of economic downturn) (Krasowska-Walczak, 1996).

The changes in the level of the deficit may be the results of changes of the business cycle and/or changes in the approach of the fiscal policy. In the period of recession, the budget deficit grows (because of the restriction of the tax base and increase in the number of citizens needing social help from the state) and in the peak of the business cycle it falls. The changes of the level of budget deficit are only an indicator for the determination of the character of fiscal policy conducted by the state. When assessing this policy, apart from the level of budget deficit, the current state of the business cycle has to be taken into consideration.

### 3 Changes in levels of the economic growth in the countries of the Visegrad group in years 2002-2011

The current business cycle is the basic factor influencing both the state of public finances as well as the way in which the fiscal policy is conducted. In table 1 the data concerning the rise of GDP in the countries of Visegrad Group in years 2002-2011 is presented.

Table 1. Economic growth in the countries of the Visegrad Group in years 2002-2011

| Years | Country | | | | |
|---|---|---|---|---|---|
| | EU 27 | Czech Republic | Poland | Slovakia | Hungary |
| 2002 | 1.3 | 2.1 | 1.4 | 4.6 | 4.5 |
| 2003 | 1.5 | 3.8 | 3.9 | 4.8 | 3.9 |
| 2004 | 2.5 | 4.7 | 5.3 | 5.1 | 4.8 |
| 2005 | 2.1 | 6.8 | 3.6 | 6.7 | 4.0 |
| 2006 | 3.3 | 7.0 | 6.2 | 8.3 | 3.9 |
| 2007 | 3.2 | 5.7 | 6.8 | 10.5 | 0.1 |
| 2008 | 0.3 | 3.1 | 5.1 | 5.8 | 0.9 |
| 2009 | -4.3 | -4.7 | 1.6 | -4.9 | -6.8 |
| 2010 | 2.0 | 2.7 | 3.9 | 4.2 | 1.3 |
| 2011 | 1.5 | 1.7 | 4.3 | 3.3 | 1.6 |

Source: Eurostat, Economy and finance, National accounts, recovered on 10.08.2012

For the analyzed period, the lowest indicators of the economic growth occurred in year 2002 (and in year 2003 in case of Hungary) as well as in year 2009. By analyzing the pace of the economic growth for the entire examined period one can state that the countries of the Visegrad Group were developing faster than the average for the European Union. Therefore, there is successive bridging of the gap from the side of the analyzed in comparison to the European Union. Hungary is the weakest in this listing as in the period of 2007-2010 it noted the level of economic growth lower that the average for the European Union. The fastest developing country in the Visegrad Group is Slovakia, even despite recession faced in year 2009.

While considering the conditions of conducting the fiscal policy, the period of maintaining a high business cycle, allowing the improvement of the financial condition in the public sector is important. For all of the 27 European Union countries, as well as for three out of four Visegrad Group countries included in the listing, the lower turning points of the business cycle appeared in years 2002 and 2009. The interval between the neighboring low turning points was six or seven years, the last period of improvement of the business cycle was therefore very short. Economic decision-makers could expect further economic growth, based on the experiences from the previous business cycles, hoping for an eight to ten year period of business cycle improvement. It has to be added that in year 2002, which was the previous turning point of the business cycle, the economic growth for the 27 European Union countries amounted 1.3% and in case of the countries of the Visegrad Group it amounted from 1.4% to 4.6%. In the next lower turning point there was a deep recession on the level of 4.3% drop in the GDP (for the EU-27)

and in the countries of the Visegrad Group (excluding Poland) exceeding the European Union average. Even if the economic decision maker expected the downturn of the business cycle, the scale of it was surprisingly high. In the worst situation among the analyzed countries was Hungary, which noted the economic growth of the level below 1% as early as from year 2007.

### 4 Changes in the level of budget deficit and public debt in the countries of the Visegrad group in years 2002-2011

Data concerning budget deficit in the countries of the Visegrad Group are presented in table 2.

Table 2. Budget deficit as the percentage of GDP in the countries of Visegrad Group in years 2002-2011

| Years | Country | | | | |
|---|---|---|---|---|---|
| | EU 27 | Czech Republic | Poland | Slovakia | Hungary |
| 2002 | -2.6 | -6.5 | -5.0 | -8.2 | -9.0 |
| 2003 | -3.2 | -6.7 | -6.2 | -2.8 | -7.3 |
| 2004 | -2.9 | -2.8 | -5.4 | -2.4 | -6.5 |
| 2005 | -2.5 | -3.2 | -4.1 | -2.8 | -7.9 |
| 2006 | -1.5 | -2.4 | -3.6 | -3.2 | -9.5 |
| 2007 | -0.9 | -0.7 | -1.9 | -1.8 | -5.1 |
| 2008 | -2.4 | -2.2 | -3.7 | -2.1 | -3.7 |
| 2009 | -6.9 | -5.8 | -7.4 | -8.0 | -4.5 |
| 2010 | -6.5 | -4.8 | -7.9 | -7.7 | -4.3 |
| 2011 | -4.5 | -3.1 | -5.1 | -4.8 | 4.2 |

Source: Eurostat, Economy and finance, Government statistics, recovered on 10.08.2012

The data from table 2 confirms the theoretical assumption that the budget deficit diminishes in the period of the business cycle improvement while it grows in the period of the worse business cycle. This regularity occurs both in the entire economic grouping (EU-27) as well as in the analyzed countries of the Visegard Group. It has to be emphasized that up to the occurrence of the economic breakdown in the year 2009, the countries of the Visegard Group were characterized by budget deficit levels higher than the average for the European Union. In years 2002-2008 this was especially seen in case of Hungary. The only country in which budget deficit in the entire period exceeded the EU average is Poland.

The comparison of data from tables 1 and 2 allows us to answer the question what fiscal policy was conducted by the particular countries in the examined period. The only country in case of which the forming of budget deficit can indicate a deliberate fiscal policy is Hungary. In the period 2002-2006 Hungary was characterized by a very high level of budget deficit which may indicate the conducting of systematic deficit policy, characterized by the surplus of public expenditures over income even in the period of economic growth, in order to further stimulate the business cycle. Unfortunately, this policy did not lead to the sufficiently high level of economic growth that would allow the repaying of the high debt of the country. Hungary was forced to increase the restrictiveness of the fiscal policy which resulted in the stagnation of the economy even as early as in year 2007. The data characterizing Hungary indicate that, contrary to the assumptions of the neoclassic approach, the fiscal policy influences the forming the level of economic activity. Unfortunately, the restrictive fiscal policy is more effective in cooling the economy than the expansive fiscal policy is in accelerating it.

In the other countries of the Visegrad Group, the level of budget deficit in the analyzed period was more the result of spontaneous economic processes rather than deliberate fiscal policy. The level of budget deficit was the resultant of the business cycle rather

than the instrument of stimulating or cooling the business cycle. The analyzed countries did not strive to balance the budget. While it is true that budget deficit in Slovakia was kept on low level, this country did not try to balance the budget (as it is advised by the neoclassical approach and the concept of cyclic budgets) even in year 2007 when the economic growth exceeded the level of 10%. In case of Czech Republic and Poland higher levels of budget deficit did occur in the period of weaker business cycle, lower levels on the other hand, in the peak of the economic business cycle. A relatively high level of budget deficit in Poland in years 2009-2010 has to be noted, as it exceeded the average for the European Union in the conditions when Poland as the only country of the European Union was not experiencing recession. Probably it is one of the basic factor (next to a significant weakening of the Polish zloty which caused the increase of export) supporting the maintaining of the economic growth. Taking into consideration the determination of the Polish government to lower budget deficit, it seems to be more of the effect of shifting the cuts in time rather than of a deliberate policy of creating high budget deficit in order to maintain the business cycle. Conducting the fiscal policy in a passive way (correcting it only to small extent in the periods of budget tensions), on one hand makes it possible to avoid potential errors related to the active policy, on the other hand deprives the decision makers of its potential successes. By conducting a more flexible fiscal policy than in case of cyclic fiscal policy, the state does not gather 'supplies' in the period of good economic cycle which restricts the possibilities of supporting the economy in the period of crisis.

The fact whether the state even can use the fiscal policy to be the tool of stimulating the economic cycle in the period of crisis depends on its existing debt. In the conditions of high public debt, investors on the financial markets expect significantly higher interest rates of debt securities. This can lead to spiraling debt. The state is perceived to be insolvent, is forced to introduce the restrictive fiscal policy which deepens the drop of the economic activity, automatically making the fiscal troubles worse. In table 3 the data concerning the level of public debt in relation to GDP in the countries of Visegrad Group in years 2002-2011 is presented.

Table 3. Public debt as a percentage of GDP in the countries of the Visegrad Group In years 2002-2011

| Years | Country | | | | |
|---|---|---|---|---|---|
| | EU 27 | Czech Republic | Poland | Slovakia | Hungary |
| 2002 | 60.4 | 27.1 | 42.2 | 43.4 | 55.9 |
| 2003 | 61.9 | 28.6 | 47.1 | 42.4 | 58.6 |
| 2004 | 62.3 | 28.9 | 45.7 | 41.5 | 59.5 |
| 2005 | 62.9 | 28.4 | 47.1 | 34.2 | 61.7 |
| 2006 | 61.6 | 28.3 | 47.7 | 30.5 | 65.9 |
| 2007 | 59.0 | 27.9 | 45.0 | 29.6 | 67.1 |
| 2008 | 62.5 | 28.7 | 47.1 | 27.9 | 73.0 |
| 2009 | 74.8 | 34.4 | 50.9 | 35.6 | 79.8 |
| 2010 | 80.0 | 38.1 | 54.8 | 41.1 | 81.4 |
| 2011 | 82.5 | 41.2 | 56.3 | 43.3 | 80.6 |

Source: Eurostat, Economy and finance, Government statistics, recovered on 10.08.2012

The data concerning public debt confirm the observations made on the occasion of the analysis of budget deficit. The condition of public finances is improving in the period of the business cycle upturn while it is becoming weaker in the period of economic downturn. When comparing the data concerning the entirety of the European Union and the countries of the Visegard Group, it has to be noted that in case of the latter the levels of public debt are noticeably lower than the average for the European Union. The only exception is Hungary, public debt of

which in the years 2006-2010 exceeded the average level of the Union. It was probably the basic reason for the increase of the restrictiveness of the fiscal policy which led to the drop of the level of public debt in Hungary in the year 2011 to the level below the Union average. Unfortunately, the level of public debt in Hungary still exceeds 80% of GDP which forces the state to keep the restrictive fiscal policy.

In year 2011 the Czech Republic and Slovakia were in the best situation, as their public debt barely exceeded the level of 40% of GDP. With such level of debt the country has the possibility of loosening the fiscal policy (or reducing the fiscal restrictions) in order to stimulate the economy. Poland is in a bit worse situation, while the level of its debt is not on the level threatening its solvency which therefore leaves the potential possibility of easing the restrictions of the fiscal policy.

**5 Summary**

Statistical data concerning the forming of the pace of economic growth, the level of budget deficit and public debt in the countries of the Visegrad Group confirms the argument stated in the introduction. The condition of public finances changes according to the business cycle and the level of public debt in the countries belonging to the Visegrad Group is low enough so that it does present the danger of insolvency. The only country that could have been threatened by insolvency was Hungary which accepted the fiscal restrictions early enough (in year 2007). Unfortunately, the side effect of those was the economy facing stagnation, even before the global economic crisis. Still the debt of Hungary was so high that it was necessary to maintain the restrictive fiscal policy. The level of debt of the Czech Republic, Slovakia and also (to a lesser degree) Poland is low enough that these countries may decide to reduce the fiscal restrictions or even to conduct the expansive fiscal policy.

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# I    INFORMATICS

IN    INFORMATICS

# COMPLEX PERFORMANCE EVALUATION OF PARALLEL LAPLACE EQUATION

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Abstract: With the availability of powerful personal computers and networking devices, the recent trend in parallel computing is to connect a number of individual workstations (PC, PC SMP) to solve computation-intensive tasks in parallel way on such clusters (NOW, SMP, Grid). Current trends in high performance computing (HPC) are to use networks of workstations (NOW, SMP) as a cheaper alternative to traditionally used massively parallel multiprocessors or supercomputers. In this article we discuss such complex performance evaluation of iterative parallel algorithms (IPA) and their practical implementations (Jacobi and Gauss-Seidel iteration). On real example we demonstrate the influences in process of modelling and performance evaluation and the consequences of their distributed parallel implementations.

Keywords: network of workstations, iterative parallel algorithms, decomposition strategy, inter – process communication, performance evaluation

## 1 Introduction

There has been an increasing interest in the use of networks of distributed workstations (cluster) connected together by high-speed networks for solving large computation-intensive problems. Network of workstations (NOW) [7, 10] has become a widely accepted form of high-performance parallel computing. Each workstation in a NOW is treated similarly to a processing element in a multiprocessor system. However, workstations are far more powerful and flexible than processing elements in conventional multiprocessors.

## 2 Models of parallel systems

In principal we can divide parallel algorithms into two following classes

• parallel algorithm using shared memory. These algorithms are developed for parallel computers with dominated shared memory as actual symmetrical multiprocessors or multicore systems (SMP)

• parallel algorithm using distributed memory (DPA). These algo-rithms are developed for parallel computers with distributed memory as actual NOW system and higher integration Grid systems.

The main difference is in form of inter - process communication (IPC) among individual parallel processes

The load balancing, inter process communication and transport protocol for such machines are being widely studied [4, 9, 10]. With the availability of cheap personal computers, workstations and networking devises, the recent trend is to connect a number of such workstations to solve computation intensive tasks in parallel processes.

## 3 Complex performance evaluation

To performance evaluation of parallel algorithms we can use analytical approach to get under given constraints analytical laws or some other derived analytical relations [2]. The most known analytical relations have been derived without considering architecture and communication complexity. In NOW [4, 6], we have to take into account all aspects that are important for complex performance evaluation. Theoretically we can use following solution methods to get a function of complex performance

• analytical
  ▪ application of queuing theory results [8, 9]
  ▪ order (asymptotic) analyse [5]
  ▪ Petri nets [13]
• simulation methods [1]
• experimental
  ▪ benchmarks [15]
  ▪ direct measuring [12,11].

Analytical method is a very well developed set of techniques which can provide exact solutions, but only for a very restricted class of models. For more general models it is often possible to obtain approximate results significantly more quickly than when using simulation, although the accuracy of these results may be difficult to determine.

Simulation is the most general and versatile means of modelling systems for performance estimation. It has many uses, but its results are usually only approximations to the exact answer and the price of in-creased accuracy is much longer execution times.

Evaluating system performance via experimental measurements is a very useful alternative for computer systems. Measurements can be gathered on existing systems by means of benchmark applications that aim at stressing specific aspects of computers systems.

### 3.1 Performance evaluation metrics

To evaluating parallel algorithms there have been developed several fundamental concepts.

**Speed up**

Let O(s, p) be the total number of unit operations performed by p processor system, s defines size of the computational problem and T(s, p) be the execution time in time units. Then speedup factor is defined as

$$S(s,p) = \frac{T(s,1)}{T(s,p)}$$

**Efficiency**

The system efficiency for a p processor system is defined by

$$E(s,p) = \frac{S(s,p)}{p} = \frac{T(s,1)}{p\,T(s,p)}$$

**Isoefficiency concept**

We denote the workload w = w (s) as a function of size of the problem s. For parallel algorithms we define an isoefficiency function relating workload to machine size p needed to obtain a fixed efficiency E when implementing a parallel algorithm on a parallel computer. Let h (s, p) be the total overhead function involved in the parallel algorithm implementation. The efficiency of a parallel algorithm is defined as

$$E(s,p) = \frac{w(s)}{w(s) + h(s,p)}$$

The workload w(s) corresponds to useful computations while the overhead function h(s, p) represent useless overheads times. With a fixed problem size, the efficiency decreases as p increase. Therefore, one can expect to maintain a constant efficiency if the workload w is allowed to grow properly with increasing machine size (scalability).

We rewrite equation for efficiency E(s, p) as follows

$$w(s) = \frac{E}{1-E} h(s,p)$$

The factor C = E / 1 - E is a constant for a given fixed efficiency E.

## 4 System of linear equations

There exist many various ways how to solve system of linear equations. But there does not exist any universal optimal way of solving it. The existed methods can be divided into exact (finite) and iterative ones.

### 4.1 Exact methods

These methods come after deterministic number of steps to the exact solution. To these methods belong
- Cramer rule
- Gaussian elimination methods (GEM) and their alternatives.

### Cramer rule

Application to solving system of linear equations has its bottlenecks in the extensive calculation of sub determinants. If the number of un-known n is high, so the whole computation time for individual sub determinants raise exponentially [4]. This fact does not change the possibility to compute the sub determinants in a parallel way.

### Gaussian elimination method

Gaussian elimination method GEM (commonly marked as LU factorisation), which are with their known alternatives (GEM with pilot element, Gauss-Jordan elimination, special types of systems - Choleskyfactorisation etc.) the most used exact methods of solving the system of linear equations. For this methods were developed sequential and parallel versions of application algorithms. To the standards belong BLAS (Basic Linear Algebra Subprograms), and innovated versions LINPACK (Linear Package), LAPACK (Linear Algebra Package), ScaLAPACK (Scalable LAPACK), PBLACS (Parallel Basic Linear Algebra Communication Subprograms).

### 4.2 Iteration methods

In using the exact methods on the computers we could not come in many cases to the exact solution. To these methods belong iterative methods
- Jacobi iteration method
- Seidel iteration method.

The difference to the Jacobi iteration method is in it that she uses also the newest just computed elements of new calculated iteration vector (in the same iteration step) to the calculation of other elements. This is in matrix form as

$$X^{(k+1)} = D . X^{(k+1)} + H . X^{(k)} + P$$

, where D is lower triangular part M and H is the upper triangular part of matrix M.

## 5 Parallel applications of iterative algorithms

Partial differential equations (PDE), is the equation involving partial derivates of an unknown function with respect to more than one independent variable [3, 14]. PDEs are of fundamental importance in modeling all types of continuous phenomena in nature. We will confine our attention to PDE with two space independent variables x, y. The needed function we denote as u (x, y). The considered partial derivations we denote as $u_{xx}$, $u_{xy}$, $u_{yy}$ etc. For practical use the most important PDE are two ordered equations and that mainly
- heat equation, $u_t = u_{xx}$
- wave equation, $u_{tt} = u_{xx}$
- Laplace equation $u_{xx} + u_{yy} = 0$.

Here we show how to solve in parallel way specific PDE – Laplace equation in two dimensions – by means of a grid computation method (Fig.1.) that employs finite difference method. Although we focus on this specific problem, the same techniques are used for solving other PDE extensive approximations calculations on various parallel computers (supercomputers, NOW, Grid). Laplace equation is a practical example of using iterative methods to its solution. The equation for two dimensions is following

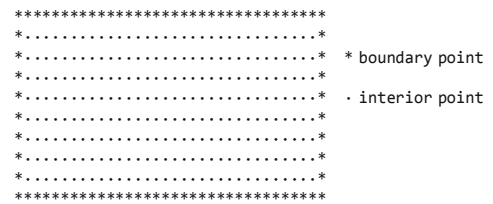$$\frac{\delta^2 \Phi}{\delta x^2} + \frac{\delta^2 \Phi}{\delta y^2} = 0$$

```
*********************************
*...............................*
*...............................*   * boundary point
*...............................*
*...............................*   · interior point
*...............................*
*...............................*
*...............................*
*...............................*
*********************************
```

Fig. 1.Grid approximation of Laplace equation.

Function $\Phi$ (x,y) represents some unknown potential, such as heat, stress etc. Given a two-dimensional region and values for points of the region boundaries, the goal is to approximate the steady-state solution $\Phi$ (x,y) for points in the interior by the function u (x,y). We can do this by covering the region with a grid of points (Fig. 1) and to obtain the values of u (xi,yj) = u i,j. Let us consider square region (a,b) x (a,b).
For coordinates of grid points is valid
xi = i*h, yj = j*h, h = (b-a) / N for i,j = 0, 1, ..., N.
We replace partial derivations of $\Phi \sim u(x,y)$ by the differences of u i,j. After substituting we obtain final iteration formulae as

$$X_{i,j}^{(t+1)} = (X_{i-1,j}^{(t)} + X_{i+1,j}^{(t)} + X_{i,j-1}^{(t)} + X_{i,j+1}^{(t)}) / 4$$

orits alternative version

$$X_{i,j}^{(t+1)} = (4 X_{i,j}^{(t)} + X_{i-1,j}^{(t)} + X_{i+1,j}^{(t)} + X_{i,j-1}^{(t)} + X_{i,j+1}^{(t)}) / 8$$

Each interior point is initialised to some value. The steady-state values of the interior points are then computed by repeated iterations. In each iteration the new value of a point is set to a combination of the previous values of neighbouring points. The computation terminates either after a given number of iterations or when every new value is within some acceptable difference Epsilon > 0 of the previous value.

### 5.1 Local communication

For Jacobi finite difference method a two-dimensional grid is repeatedly updated by replacing the value at each point with some function of the values at a small fixed number of neighbouring points. The common approximation structure uses a four-point stencil to update each element Xi,j (Fig. 2.).
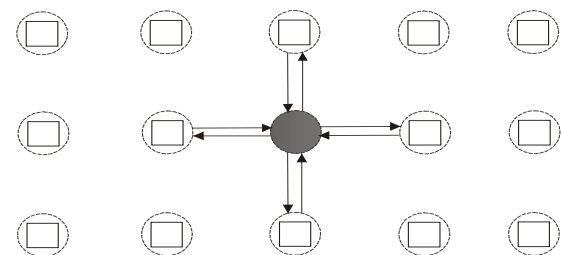
Fig. 2. Communication for 4 - points approximation.

To perform the needed communication we have to do

```
for t = 0 to t-1 do
  begin
    send X_i,j^(t) to each neighbours;
    receive X_i-1,j^(t),X_i+1,j^(t),X_i,j-1^(t),X_i,j+1^(t) from
neighbours;
    calculate X_i,j^(t+1) using derived relations;
  end for;
```

## 6 Method of direct measuring

The flow diagrams for measurement in SMP parallel computers and for distributed parallel computers (NOW, Grid) differ in form of IPC communication on the level of inter-process communication (IPC) among decomposed parallel processes. The developed iterative parallel algorithms were divided to the two logical parts – manager and worker programs. Both programs are in Win API. Part manager is an application and part service is its service. Manager control the computer with starting services (sending the initial values to all worker computation), makes the connections and starts in parallel way the remote functions. At the end gathers the particular results. Service waits to starting point of the solving in manager controlled interval. After computation it gets back to manager computing results including time of its duration.

## 7 Decomposition models

To experimental measurement we developed effective iterative parallel algorithms (IPA) to solving Laplace equation with Jacobi methods and Gauss-Seidel (Red-black parallelisation) with following input parameters
•    n – number of grid points
•    E – accuracy of iteration (Epsilon)
•    p – number of processors.

The parallel algorithms were developed in C language using MPI functions in version MPICH (Message Passing Interface Chameleon). The algorithms are divided into two logical parts – manager and worker program. Manager controls every worker through starting services (initial values to all workers), makes the connections and starts the remote functions. At the end manager gathers from worker particular results.
Iteration process ends in reaching defined accuracy or in over exceeding defined number of iterations. After computation service program get back to manager computing results including time of its duration. To measurements we used known decomposition methods (Fig. 3.).
•    decomposition of grid points to strips  – decomposition 1. At each iteration „boundary points" (always two boundary rows) are shared by neighbouring processors and after each iteration are interchanged according to Fig. 3.
•    decomposition of grid points to square blocks – decomposition 2. In each iteration „boundary points" (always four edges) are shared by neighbouring processors and the points are interchanged after each iteration along every of these four these edges principally according to Fig. 3
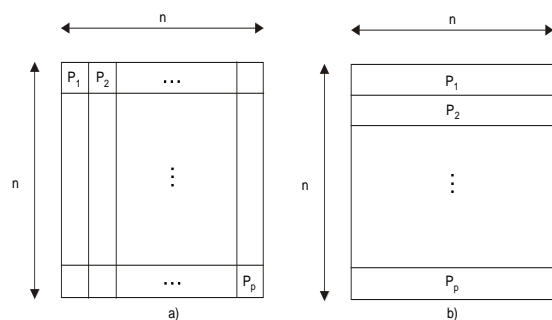


Fig. 3. Decomposition a) blocks b) strips.

## 8 Results in NOW

All the realised measurements of developed IPA in NOW can be divided to
•    calibration of the used workstations in NOW – verifying of their performance  for various workload
•    measurements of the calculation times and their individual components in relation to workloads for various values of input parameters.
From achieved results I illustrate at Fig. 4. The individual relative parts of whole performance time (Gathering data, Communication time, Calculation time, Initialisation time) for

given matrix sizes. To other results I will referee in my next articles
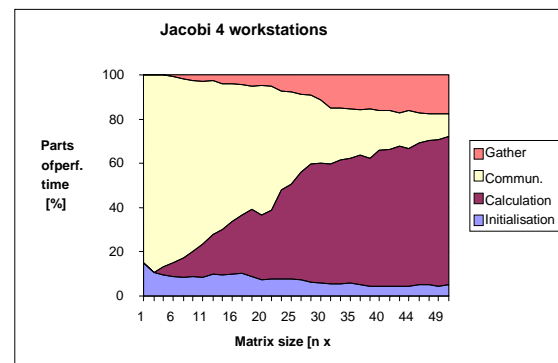


Fig. 4. Individual relative parts of performance time.

## 9 Conclusions

Therefore in relation to our achieved results we are able to do better load balancing among used network nodes (performance optimisation of parallel algorithm). For these purposes we can use calibration results of individual network nodes in order to divide the input load according the measured performance power of used network nodes. Second we can do load balancing among network nodes based on modern SMP parallel systems and on network nodes with only single processors. Generally we can say that the parallel algorithms or their parts (processes) with more communication (similar to analysed Gauss-Seidel parallel algorithm) will have better speed-up values using modern SMP parallel system as its parallel implementation in NOW. For the algorithms or processes with smaller communication overheads we can use the other network nodes based on single processors.

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**Primary Paper Section:** I

**Secondary Paper Section:** IN, JD, BA

# J    INDUSTRY

# BUILDING MATERIALS PROPERTIES CHARAKTERISED BY ALTERNATING ELECTRIC FIELD

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Abstract: NDT method of impedance spectroscopy was used to characterize concrete slab specimens without and with contact graphite compound coating. Differences in tan $\delta$ (f), Im Z(f) and Re Z(f) spectra for dry specimens were observed. Furthermore, based on the predominant loss type, the material quality was characterized. Our measurements confirmed the reproducibility of this method. Furthermore, the influence of the concrete specimen composition on their electric parameters was assessed.

Keywords: impedance, spectroscopy, dielectric losses, loss factor, conductivity losses, polarization losses

## 1 Introduction

The impedance spectroscopy is a non-destructive testing method employing the impedance characteristic frequency dependence to analyzing the properties of the material in question. The experiment set-up designed to study the system under investigation includes: a metal-material-metal network, which is relevant for identifying the application limits of the impedance spectroscopy method. The method cannot be applied to thick-layer low-conductivity materials. Reinforced concrete products may serve as an example. The principle of the mentioned method consists is studying the dielectric losses versus frequency plots. The dielectric losses of composite materials and plastics can assume values which are many times as high as those of most material commonly used in the building industry.
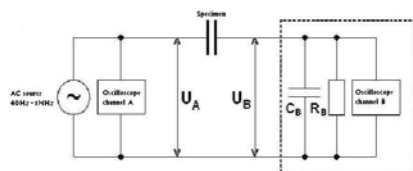


**Fig. 1.** Measuring set-up and one of specimens. [1].



**Fig. 2.** Circuit diagram of the measuring set-up: AC power supply, specimen under test, double-channel oscilloscope [1].

Analysis of impedance spectra of inhomogeneous materials is a part of the impedance spectroscopy which is still waiting for its development. At present, one is not able to determine unambiguously the individual material component contributions to the total electric conductivity and polarization at various frequencies of the exciting field. Materials having higher electric resistance values (over 500 kΩ) can be regarded – under certain simplifying assumptions – as dielectrics. A theory of dielectric polarization was formulated by Debye [12,13] for homogeneous materials. However, experiments carried out on real materials and the respective conclusions did not show to be in agreement with the fundamentals theories. K S Cole and R H Cole and, also, Fuoss and Kirkwood, started from the Debye's theory to derive models of a dielectric which appear to fit experiment results and conclusions [12] more closely. The behavior of a dielectric in an AC electric field is best described in terms of the complex relative permittivity. Debye has derived a formula for the complex relative permittivity, $\varepsilon^*$, of weakly polar liquid dielectrics, as follows:

$$\varepsilon^*(j\omega) = \varepsilon_\infty + \frac{\varepsilon_s - \varepsilon_\infty}{1 + j\omega\tau}. \qquad (1)$$

Here $\tau$ is the relaxation time, independent of the time, however dependent on the temperature, $\varepsilon_s$ - static permittivity (frequency → 0 Hz), $\varepsilon_\infty$ - optical permittivity (frequency → ∞ Hz), angular frequency $\omega=2\pi f$, $f$ - frequency of the exciting electric field [12, 13].

Following equation holds for the loss factor tan $\delta$:

$$\tan\delta = \frac{\varepsilon''(\omega)}{\varepsilon'(\omega)} = -\frac{(\varepsilon_S - \varepsilon_\infty)\omega\tau}{\varepsilon_S + \varepsilon_\infty\omega^2\tau^2}. \qquad (2)$$

There are several different relaxation times in a real dielectric. Their distribution is described by a distribution function. Exact determination of a suitable distribution function being difficult, an approximation by a properly selected analytical function is usually carried out. According to Cole's, the complex relative permittivity can be expressed as follows [7]:

$$\varepsilon^*(j\omega) = \varepsilon_\infty + \frac{\varepsilon_S - \varepsilon_\infty}{1 + (j\omega\tau_1)^{1-\alpha}}. \qquad (3)$$

Here, $\tau_1$ is the most probable relaxation time, around which the particular relaxation times are distributed according to a distribution function $f(\tau)$, where $\alpha$ is a distribution parameter $(0<\alpha<1)$.

J R Macdonald [13] made a reference to the formal equivalence between the complex relative permittivity as described by equations (1), (3), and the formulas for a complex impedance Z. Formulas for the real and imaginary components of the complex relative permittivity have been derived and, based on the above mentioned equivalence, equations for the components of the complex specific impedance have been obtained. Using an appropriate software package, parameters of the two model types have been searched for the material under investigation. The degree of correlation between the model and experiment properties is expressed by means of Pearson's correlation coefficient $r$ [12].
The frequency dependence of the quantities studied by the impedance spectroscopy method is determined from the relative voltage ($U_B/U_A$) and the phase shift ($\Delta\varphi$) between the double-channel oscilloscope A and B-channels (Fig. 2).

An external electric field gives rise to dielectric losses in the specimen in consequence of three different effects:

*Dipole polarization relaxation*: It occurs in polar materials. Being accompanied by energy losses in a dielectric, it is temperature and frequency dependent. The set-up time: $10^{-12}$ to $10^{-8}$ s in low-molecular compounds, being a great many orders of magnitude higher in macromolecular compounds.

*Ion polarization relaxation*: It occurs in non-dense ion-packing ion solids (inorganic glasses, ceramics). Being accompanied by energy losses in a dielectric, it is temperature and frequency dependent. The set-up time: $10^{-13}$ to $10^{-8}$ s.

*Electric conductivity*: Losses arise in both DC and AC conductivity processes, giving rise to the electric field losses and their conversion into Joulean heat. The physical nature of the losses consists in free-charge-carrier scattering by oscillating particles constituting the solid structure.

The relaxation polarization is a phenomenon which is characterized by slow response, by contrast to the elastic polarization, in which the recovery is almost instantaneous. Let polar particles of different kind exist in a dielectric being only loosely bound to their neighbours. These particles will simultaneously perform oscillations and chaotic displacements with respect to their environment. If an external electric field is applied, these thermal movements will be gradually aligned with the direction of this electric field. In this way, there arises a non-symmetric distribution of electric charges, thus giving rise to a dipole moment. Both the polarization growth and decrease (after the external electric field is switched off) are proceeding slowly. The relaxation polarization is temperature dependent, being always accompanied by dielectric losses and dielectric heating. Thermal ionic polarization and thermal dielectric (dipole) polarization are the main types in this category.

**2 Material to be Measured**

For the impedance spectroscopy measurements, our concrete specimens of dimensions 100 mm x 100 mm x 400 mm (Fig. 3) have been split so as to reduce their thickness to 10 mm, i.e., 100 mm x 100 mm x 10 mm.

The specimen composition follows from the formula, see Table 1.

**Table 1.** Concrete component percentage

| C 30/37 XF4, S4, surface NH | | |
|---|---|---|
| | kg/m³ | % |
| CEM I 42,5R | 320 | 14,45 |
| Slug 420 | 100 | 4,52 |
| Water | 210 | 9,48 |
| Spolostan 7L | 4 | 0,18 |
| Chrysoair | 0,15 | 0,01 |
| Halámky D5 0/4 | 800 | 36,13 |
| Rejta 4/8 | 280 | 12,65 |
| Rejta 8/16 | 500 | 22,58 |



**Fig. 3** Two concrete specimens intended for the temperature measurement, immediately after having been poured into the beams.
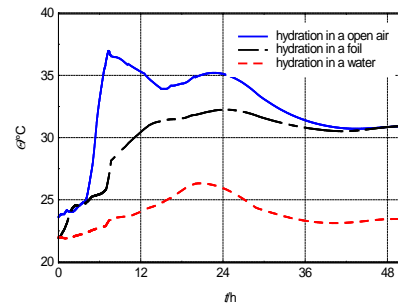


**Fig. 4.** Monitoring the temperature inside the concrete specimens during the concrete setting process.

**3 Experimental Set Up**

The experiments, described below, was making by using sinus signal generator Agilent 33220A and Agilent 54645A oscilloscope (Fig. 1):

*Experiment 1:* The experiment was designed so as to provide distinguishable impedance spectra of self - setting concrete during the setting process.

*Experiment 2:* The concrete samples were characterized after 15 days. The samples were saved at the different environment (water, air, plastic foil).

The *specimens* under investigation were inserted between two electrodes (which were pressed against the specimens using a screw fixture) and subsequently subjected to the impedance analysis.

The loss factor frequency dependence was obtained by using specific software for measurement instruments control. So the frequency dependent of imaginary part of specific impedance versus real part of specific impedance was obtained. The specific impedance values were calculated of experimental values. Of created and calculated models was determined the coefficients values, which are expressed on the Table 2.

**4 Measurements Results**

4.1 Experiment 1

The porosity or the porosity degree is related to the impedance imaginary component Im (*Z*) versus the impedance real component Re (*Z*) plot. In this plot, we can determine the angle made by the abscissa (line connecting the arc starting point with the arc centre with the impedance real axis (see Fig. 5 - the angle made by the straight line with the real axis). Putting the mentioned angle *Θ* into the formula, we can calculate the value of the n-factor, characterizing the specimen porosity degree:

$$n = 1 - \left(2\theta / \pi\right) \qquad (4)$$
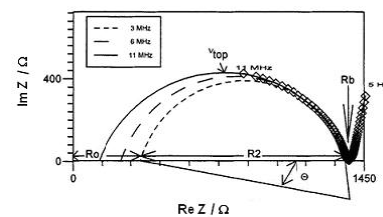


**Fig. 5.** Illustration of an impedance imaginary component Im(*Z*) versus the impedance real component Re(*Z*) plot. [8].
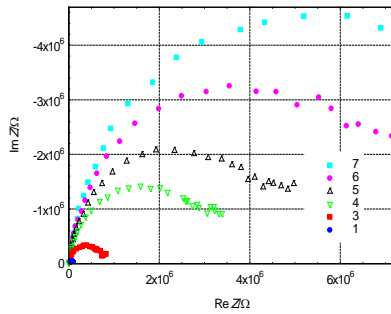
**Fig. 6.** Impedance imaginary component Im($Z$) versus the impedance real component Re($Z$) plot.

The Table 2 shows n-factors for different hydration stages calculated from the impedance imaginary and real parts.

**Table 2.** Calculated values of the n-factor in the course of concrete hydration. The concrete was fabricated on 29.03.2011

| Measurement date | Setting period (days) | $n$ |
|---|---|---|
| 30.3.2011 | 1 | 0,618 |
| 2.4.2011 | 3 | 0,899 |
| 3.4.2011 | 4 | 0,908 |
| 4.4.2011 | 5 | 0,930 |
| 5.4.2011 | 6 | 0,932 |
| 6.4.2011 | 7 | 0,933 |
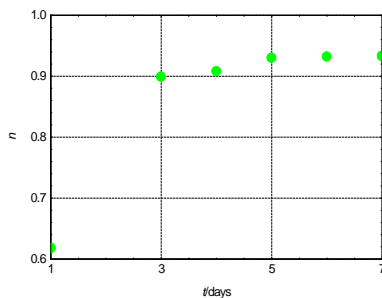


**Fig. 7.** The n-factor versus time of hydratation dependent.

It is clearly seen that the n-factor grows with the hydration time. It remains almost unchanged at the end of the 1-week cycle. The initial lines used in the n-factor calculations are shown in Fig. 6.

The drawback of this characteristic tracking method (Fig. 6) consists in the need for equal - thickness specimens being cut from the original specimen. From this point of view, the loss factor (tan $\delta$) versus frequency ($f$) plot is more convenient (in Fig. 6, the frequency is plotted in a logarithmic scale for lucidity). The loss factor, as a parameter, is a pure material constant. It is related neither to the specimen size, nor to its dimensions [10].

In Figure 6, the curve gradation corresponds to a one - day time interval between the measurements. The values of the curve obtained after the first hydration day (30.03.2011) are by several orders of magnitude lower as compared with the other ones, so that this curve is difficult to identify in the diagram.
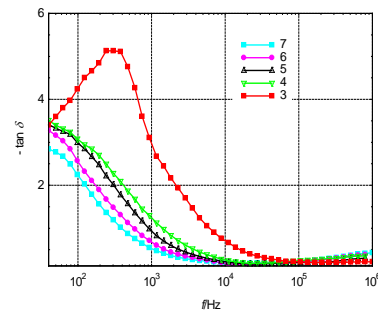


**Fig. 8.** Loss factor versus frequency plot for a concrete specimen (the frequency being plotted in log scale).

Fig. 8 diagram shows clearly the predominance of conductivity losses in the material (the loss factor tan $\delta$ decreasing with the frequency) throughout all concrete hydration stages. The longer the hydration time was, the lower the loss factor values were measured (almost throughout the whole frequency spectrum). For example, the sixth day minus the first day hydration tan $\delta$ value is about 2.5 for the frequency of 1 kHz. It means that the material electric conductivity decreased during the hydration process. One might assume that the lower the material conductivity (which in turn is due to newly formed capillary pores) the lower loss factors at given frequencies, however, the loss factor value depends on the material permittivity, too. It follows from the Im $Z$(Re $Z$) phasor diagram, that when the impedance real part is going down, the impedance imaginary part is decreasing as well. This is in a good agreement with the growing loss factor. The predominance of the polarization losses (growing trend of tan $\delta$) was observed after the first hydration day only at frequencies below about 500 Hz. When the water content grows, the material loss factor grows as well. In general, polarization mechanisms can be used to characterize the material water content, elasticity variations, defect occurrence etc.

4.2 Experiment 2

Fig. 9 shows experimental frequency spectra of the loss factor tan $\delta$ for the indicated range of frequencies f. The loss factor reaches maximum values at the lowest frequencies of the exciting electric field being applied.
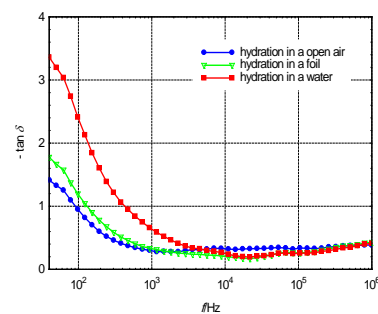


**Fig. 9.** The dielectric loss factor spectra versus frequency after 15 days of hydration at different environmental.
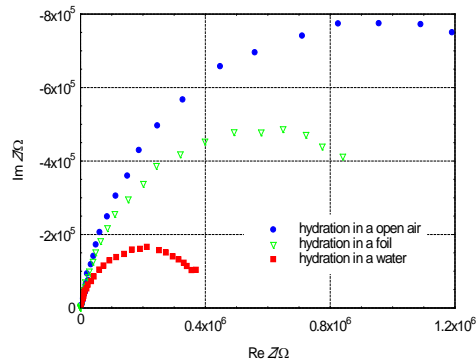
**Fig. 10.** The specific impedance values of concrete hydratation at different environmental.

It is seen that the concrete specimens whose hydration took place in water feature a higher loss factor than those hydrated in a foil or in the open air up to a frequency of about 4 kHz, where the spectra are nearing each other. Higher values of the loss factor (Fig 9) in the spectrum low - frequency region give evidence of the relaxation processes to influence the resulting tan $\delta$ spectrum in the low - frequency region more strongly than in the higher - frequency region. It can be presumed that a local extreme of the loss factor tan $\delta$ is lying in the low - frequency region (outside the frequency range used) for the concrete specimens under investigation. For the local extreme in question, the reciprocal value of the frequency equals the most probable relaxation time of the material in the defined frequency range (for the current specimen condition, i.e., composition, hydration degree, water content). From the spectrum differences, we may infer the most probable relaxation time to be higher for the open - air - hydrating specimen. The most probable relaxation time of the foil - ageing specimen appears to be closest to the most probable relaxation time of the specimen in question, the relaxation time distribution being similar to that of the open - air - hydrating specimen. From 4 kHz upwards, all loss factor curves show fluctuations, however, a trend is clearly apparent. The specimen that has hydrated in the open air shows different loss factor values than the other specimens in the frequency interval from 9 kHz to 100 kHz. All spectra show a slight loss factor increase in the high frequency region. This can be explained by either the presence of water in the aggregates or in the specific aggregate kind (Halámky stone quarry – 0/4 fraction – kind of granite). The second hypothesis is in a better agreement with the conclusions concerning the characterization of the kinds of granite in dry and wet condition by means of the impedance spectroscopy method [3]. The specific impedance spectra as measured on the material under investigation are in a good agreement with the theory of a semi - circle (Cole's, MacDonald) [12,13], whose centre has been shifted downwards below the horizontal axis (see illustrative Fig. 5).

The lowest specific impedance values have been observed throughout the exciting electric signal spectrum (the frequency is growing from the right - hand - side of the diagram to the left - hand - side, Fig. 10) for a specimen that had aged in water. At the time of the experiment, the conductivity of the specimen was higher, but the specific impedance imaginary component to the real component ratio exceeded the same ratio for other specimens. This is in a good agreement with the loss factor behavior described above. The specific impedance curves (Fig. 10) reach maximum values at different frequencies. The specimen that hydrated in the open - air peaks at 50 Hz to 60 Hz, the curve in the middle peaks at 80 Hz to 120 Hz, the last curve, at about 250 Hz.

**Table 3.** The model parameters values, obtain of dielectric loss factor spectra by using different hydratation environment, $\varepsilon_\infty$ - optical permittivity ($f{\to}\infty$), $\varepsilon_s$ - static permittivity ($f{=}0$), $\tau$ - relaxation time, $\alpha$ - distribution parameter, $r$ - Pearsons correlation coefficient, N - number of spectra points.

| Parameter / environment | Hydratation environment | | |
|---|---|---|---|
| | **water** | **plastic foil** | **air** |
| $\varepsilon_\infty$ | 72,3 | 91,6 | 99,8 |
| $\varepsilon_s$ | $5,3{\cdot}10^5$ | $3,6{\cdot}10^4$ | $1,3{\cdot}10^4$ |
| $\tau$ [s] | 6,4 | 0,964 | 0,473 |
| $\alpha$ | 0,114 | 0,176 | 0,268 |
| $r$ | 0,9924 | 0,9621 | 0,8837 |
| N | 46 | 46 | 46 |

From the loss factor spectra, complex relative permittivity values for limiting values of the exciting frequency, the most probable relaxation time $\tau$ and the distribution parameter $\alpha$ have been obtained. The dynamic permittivity of specimen having hydrated in various environments shows a rising trend, whereas the static permittivity values tend to decrease. The most probable relaxation time confirms the estimates resulting from the analysis of the loss factor spectra. The distribution parameter $\alpha$ increases if the water content in the concrete hydration environment decreases. The correlation coefficient has lowest values for the open - air - ageing concrete loss factor spectra.

**5 Conclusion**

The impedance spectroscopy method was employed to characterize the concrete hydration process stages.

The resulting change in the frequency characteristics fits the assumption that the respective physical property changes are reflected in the impedance loss factor. Dielectric losses have been described. The characteristic reproducibility was good within narrow time intervals.

For open - air hydration, a relation between the porosity (its degree) and the shape of Im $Z$ (impedance imaginary component) versus Re $Z$ (impedance real component) plot has been confirmed to exist. The characteristics proved to be reproducible within narrow time intervals.

The impedance spectroscopy method has been used to characterize concrete ageing in various environments. This was confirmed by the spectrum model, which was able to identify these values. Approximation and best - fit - search of the loss factor spectrum for the concrete specimen that hardened in the open air proved to be difficult and less accurate, which is due to the low value of Pearson's correlation coefficient.

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**Primary Paper Section:** J

**Secondary Paper Section:** JA, JB, JI, JJ, JN, JC, JG, JL

# ASSESSMENT OF SELECTED INDICATORS OF PORTLAND CEMENT CONTAINING FLY ASH IN ROAD CONCRETE

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Abstract: Concrete is traditionally made with Portland cement, a powdery substance made of ground clinker, calcium sulfate, and other minor additives. Clinker production is energy consuming process. Fly ash, which largely consists of $SiO_2$ and CO, can be used as a substitute for Portland cement, or as a supplement to it. Moreover, fly ash utilization plays an important role in environmentally clean and cost effective power generation. The aim of this paper is the study of the physical-mechanical properties of hardened fly ash - concrete composites with various proportions of fly ash as well as to economic and environmental impact of its using in building industry. The results show that the using of fly ash in road concrete production seems to be the best solution to reducing consumption of cement including environmental and economic aspects.

Keywords: fly ash, road concrete, cement, secondary raw materials, compressive strength, flexural strength.

## 1 Introduction

Industrial utilization of fly ash from coal combustion is an important environmental and economic issue. Disposal of fly ash, e.g. in a landfill, enhances the risk of contamination the ground water by leaching of heavy metals contained in the fly ash (Pedersen, K.H. et al., 2008; Hall, M.L. & Livingston, W.R., 2002). In addition, the high taxes on landfill increase the motivation to reuse fly ash (Gieré, R. et al, 2003). Today, the primary market for fly ash utilization is as pozzolanic additive in the production of concrete (Environmental assessment report no. 10, 2003). Concrete is traditionally made with Portland cement, a powdery substance made of ground clinker, calcium sulfate, and other minor additives. Clinker is a material usually made of limestone and minerals, which are crushed and ground together, then heated. Calcium sulfate is added, and the clinker is ground into cement powder. The process requires a large amount of energy; it has a huge carbon footprint, and accounts for approximately 7% to 8% of carbon dioxide emitted every year. Fly ash, which largely consists of silicon dioxide and calcium oxide, can be used as a substitute for Portland cement, or as a supplement to it. The components from fly ash consists of are pozzolanic, meaning that they can be used to bind — or cement — materials together. Pozzolanic materials, including fly ash cement, add durability and strength to concrete.

Fly ash cement is also known as green concrete. It binds the toxic chemicals that are present in the fly ash in a way that should prevent them from contaminating natural resources. Using these supplementary cementing materials in concrete pavement has several environmental benefits. First, recovering of industrial byproducts reduces the consumption of virgin materials needed for cement manufacturing. Additionally, beneficial utilization reduces the amount disposed in landfills. However, the greenhouse gas and energy reductions achievable by using SCMs (Supplementary Cementitious Materials) to replace a portion of Portland cement are more important. CO2 and energy savings are related to the percentage of SCM used in the concrete mixture design. Lot of highway government agencies in other countries allow up to 25% of Portland cement to be replaced with fly ash and 50% to be replaced with slag cement; some states even allow higher SCM replacement levels (Rafalowski, M., 2003).
Using fly ashes in road concrete brings following benefits (Green Highways, 2007; Bačíková, M. & Števulová, 2007; Krličková, E., 1998): higher ultimate strength, improved workability, reduced bleeding, reduced heat of hydration, reduced permeability, increased resistance to sulfate attack, increased resistance to alkali-silica reactivity (ASR), lowered costs, reduced shrinkage, increased durability, resistance to traffic load, resistance to pergelation.
Care should be taken when using fly ash in concrete due to: potential for decreased air entraining ability with high carbon fly ash may reduce durability, reduced early strength, reduced heat of hydration in colder climates.

## 2 Materials and Methods

Experimental works were based on standards (EN 13 877 Part1 & 2). These European standards have only determined rather general conditions for materials and methods of properties evaluation but in many ways they refer to national standards. The National standards for concrete pavements are in place. ES´s do not cancel but only partly modify them.

The materials selection for experimental works, as well as testing the contribution of fly ash to quality of road concrete was performed in the terms of national standard requirements for roads of classes I – II (motorways, international roadways, parking areas), given in table 1. Also lots of expert studies were taken into consideration; however national conditions should be respected not only in the terms of technical requirements, but also due to specific parameters of fly ash. It is well known, that properties of fly ash vary significantly and strongly depend on coal quality, conditions of combustion etc. (Števulová, N. et al, 2012).

**Table 1** Tested parameters and values required for road concrete (roads of classes I- II)

| Properties | Method | Required value |
|---|---|---|
| Consistency of fresh concrete | Slump test | S1 (10-40 mm) |
| Air content in fresh concrete | Pressure method | 4 - 8% |
| Fresh concrete temperature | Just after mixing | + 5 °C ≤ T ≤ + 30 °C |
| Compressive strength | 7, 28 and 90 days | 32 MPa (in 28 days) |
| Flexural strength | 7, 28 and 90 days | 4.5 MPa (in 28 days) |
| De-icing salts resistance | 150 freezing-thawing cycles | max. 300 $g/m^2$ /100 [1] |
| Frost resistance | 300 freezing-thawing cycles | min 0.85 [2] |

Note: [1]Rate of destruction/minimal number of cycles. Rate of destruction is expressed by scaling of tested concrete [$g/m^2$]; [2]Frost index - rate of flexural strength before and after freezing-thawing cycles.

In accordance to the proposed prescription, the C30/37 grade concrete made with 0 - 15% fly ash (class C - properties of FA are presented in Table 2) replacement of special kind of Portland cement CEM I 42,5 N. Water cementations material ratio was 0.36 and natural gravel aggregate from stone – pit Soporna and Hanisberk in specific ratio of the fine to coarse aggregate 40 (0/4): 10 (4/8): 50 (8/16, 16/32) was used in mixture.

**Table 2** Chemical compositions of fly ash

| Component  [wt. %] | | | | | | | |
|---|---|---|---|---|---|---|---|
| $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | $TiO_2$ | CaO | MgO | $K_2O$ | $Na_2O$ |
| 37.5 | 15.60 | 7.67 | 1.30 | 22.94 | 2.77 | 1.21 | 0.63 |
| MnO | $P_2O_5$ | $SO_3$ (S) | $S_{total}$ | *LOD | *LOI | *C.Sub. | *ROC |
| 0.11 | 0.18 | 7.29 (2.91) | 2.91 | 0.16 | 2.59 | 2.14 | 0.28 |

*Loss of drying  (LOD), Loss of ignition  (LOI), Combustible substances: 830 °C (C.Sub.), Residual organic carbon (ROC).

The mixtures were prepared in the laboratory mixer type ZZ 150 SH with horizontal rotary drum of 150 l capacity. Four based properties of fresh concrete: consistence, air content and temperature (EN 206-1: 2002) before the forms filing were tested according to EN 12350 (parts 3 and 7). The forms filling (the cube form with size 150 mm and the prism form with size $100 \times 100 \times 400$ mm) were performed in two layers. Each layer was compacted on the vibration plate VSB 40 for 8 seconds. Next day the composites were taken out of the forms and saved in the water bath. 144 pieces of testing composite were cured at temperature $20 \pm 2$ °C. After 7, 28 and 90 days of hardening the composites were taken out of the water bath and tested for the required properties for class of concrete C 30/37 (table 1) - the composites were tested on compressive strength (CS), flexural strength (FS), determination of concrete chemical substance resistance (STN 73 1326, STN 73 6123) as well as on freezing and thawing. For the comparative study the reference sample (RS) concrete class (C 30 / 37) was prepared in accordance with requirements of Technical standards STN 73 6123 –Road Construction. Cement Concrete Pavements. Wearing Courses.

In order to meet the strict criteria of Slovak technical legislation for using of alternative materials in constructions our study was designed with 15% fly ash replacement of cement in the concrete. The Slovak cost price calculation software CENKROS was used to demonstrate the benefit of fly ash utilization. CENKROS is software for measurement and quality control of building production. This system covers all activities associated with the preparation and execution of the contract. It allows you to prepare a quality bid quickly, to calculate costs of using the effective utilization and billing of the work performed, and to prepare price estimates by financial indicators. The expected cost saving was calculated within the study of Slovak brown coal fly ash utilization in road concrete with regard to application of raw materials in the road and highway constructions. Concrete mixture with 15% fly ash compensation in a road construction was selected for our calculation.

The road construction study of two layer cement concrete (CC) pavement of T1 tunnel on Dx highway was used as a basis for this project. Its structure and dimension is full in compliance with internal technical document no. 0803/2003 "Design of concrete-cement carriageway at road communication" of actual Slovak building company. The T1 tunnel is designed as a double-pipe highway tunnel in Slovak rural area with 80 km/h maximum speed in one way traffic, or with 60 km/h maximum speed in two way traffic (in case of closure of one tunnel pipe). The pipe length is 698 m including concrete cement pavement in front of the portal with optimum length of 50 m. Width configuration of the tunnel is specified in classification T1 = 9.0 m in terms of STN 76 7507. The engineering characteristic of the T1 tunnel on Dx highway is presented in Table 4. Economic costs were calculated without production and administrative expenses and without any profit as well. Current material inputs, team and machine utilization, and transport costs were specified for Slovak Dx highway.

**Table 4** Engineering characteristic of T1 tunnel on Dx highway

| Two - layer concrete cover | |
|---|---|
| Coated intermediate aggregate | 170/80mm |
| Infiltration road spray 1.0kg/m$^2$ | 50mm |
| Cement stabilization I | 180mm |
| Aggregate 0-32, 0-63 (20+150mm) | 270mm |

**3 Results and Discussion**

**3.1 Fresh concrete tests**

The resulting measured values of fresh concrete properties (consistency, air content, temperature) in comparison with the specific requirements of Technical Standard (TS) are presented in Table 5.

*Consistency:* All samples comply with requirement S1, while improvement in consistency is also slightly visible with increasing amount of fly ash.

*Air content:* All samples comply with requirement for 4-8%, amount of fly ash does not influence the air content significantly.

*Temperature:* All samples comply with requirement for temperature range, while increasing amount of fly ash is causing slight decrease in temperature. It is logical, due to decrease of hydration heat causing by smaller amount of clinker.

**3.2 Tests of mechanical properties of hardened concrete**

Compressive (CS) and flexural strengths (FS) development of composites based on various fly ash portions after 7, 28 and 90 days are showed in Table 5. Both strengths values of experimental composites with various portion of FA are compared with values of reference sample (RS) and with requirements Technical standards (CS – 32. 0 MPa / 28d, FS – 4.5 MPa / 28d). Based on these results it can be stated that the prepared FA concrete composites with 5 % as well as 15 % of cement replacement met the required criteria of Technical standard. With increasing amount of fly ash, slight decrease in both strengths is visible, including early strengths and ultimate strengths.

**3.3 Tests of water activity and chemical resistance; the freezing and thawing tests**

*De-icing salts resistance:* Requirement for max. 300 g/m$^2$ of scaling in 100 cycles is not fulfilled only when replacing 15% of cement with fly ash. However, it is necessary to say that testing was done in strict conditions – with 150 cycles. In publication (Brandes, Chr. & Schiebl, P., 2006), the value of scaling 1500 g/m$^2$ is classifying as small damage, while according to laboratory testing such samples did not show any degradation even at real exposure.

*Frost resistance - Frost index:* All samples comply with requirement for min. 0.85. Increase in amount of fly ash is causing decrease of frost index.

*Frost resistance - Compressive strength:* Standard requirement for value of compressive strength after freezing cycles does not defined; however we did include this in our testing. As per results, compressive strengths after freezing cycles increased slightly. Increasing amount of fly ash basically doesn't influence values of strength after freezing; decrease is only visible after 15% replacement.

**3.4 Economic assessment**

Costs were calculated with no production and administrative expenses consideration and without any profit as well. Current inputs of materials, transport costs, team and machine utilization was specified for Dx highway space. Respecting the specific technology these results came out in this calculation (Ondová, M. et al., 2011):

*Variant I.* - By 100% quantity of CEM I 42.5R Portland cement utilization for CC I production according to proposed recipe designed in catalogue items of CENKROS database the unit price 93.72 €/m$^2$ resulted.

*Variant II.* - The second alternative based on utilization of 100% quantity of CEM I 42.5R Portland cement for CC I production according to our own recipe the unit price 92.46 €/m$^2$ resulted.

*Variant III.* -The variant utilization of 85% quantity of CEM I 42.5R Portland cement for CC I production and utilization of 15% ENO fly ash according to our own recipe we obtained the unit price 86.76 €/m$^2$.

These unit prices were used for calculation of CC I pavement construction for two - layers tunnel with 698m pipe length. Summarized results are illustrated in Table 6. The most effective alternative seems to be the number III. with 15% fly ash compensation. It represents 21 260.08 € cost savings per one kilometer of cement concrete pavement (Ondová, M. & Zeleňáková, E., 2010).

**Table 5** Results of testing of fresh and hardened concrete

| Parameter | Unit | Time of testing | RS | 5 % of fly ash | 10 % of fly ash | 15 % of fly ash |
|---|---|---|---|---|---|---|
| Consistency | [mm] | - | 30 | 30 | 40 | 40 |
| Air content | [%] | - | 6.0 | 6.0 | 6.4 | 6.5 |
| Temperature | [°C] | - | 23.5 | 22.5 | 19.5 | 19.5 |
| Flexural strength | [MPa] | 7 | 5.8 | 6.1 | 5.1 | 4.9 |
| | | 28 | 6.9 | 6.6 | 6.2 | 5.6 |
| | | 90 | 8.2 | 8.1 | 7.1 | 6.8 |
| Compressive strength | [MPa] | 7 | 44.2 | 40.0 | 35.7 | 31.0 |
| | | 28 | 48.4 | 44.2 | 42.4 | 37.2 |
| | | 90 | 57.2 | 53.7 | 52.6 | 41.1 |
| De-icing salts resistance - Scaling | [g/m$^2$] | after freezing | 47.6 | 90.7 | 209.1 | 557.0 |
| Frost resistance - Flexural strength | [MPa] | before freezing | 7.1 | 6.5 | 6.2 | 5.8 |
| | | after freezing | 6.5 | 5.9 | 5.6 | 5.1 |
| Frost resistance - Frost index | [%] | - | 0.92 | 0.91 | 0.90 | 0.88 |
| Frost resistance - Compressive strength | [MPa] | before freezing | 48.6 | 45.3 | 42.7 | 38.2 |
| | | after freezing | 50.6 | 50.6 | 50.6 | 42.7 |

**Table 6** Final calculation of CC two-layer cover of pavement

| Description | Total price |
|---|---|
| CC two layer reinforced cover of pavement class I. thickness to 250mm – calculation according to the CENKROS database | 553 555.88 € |
| CC two layer reinforced cover of pavement class I. thickness to 250mm – calculation based on our own recipe with 100 % Portland cement using | 549 758.76 € |
| CC two layer reinforced cover of pavement class I. thickness to 250mm - calculation based on our own prescriptions with 85 % Portland cement using and 15% ENO fly ash using | 532 294.80 € |
| Cost saving with 15% fly ash in CC I production | 21 261.08 € |

**4 Conclusion**

Fly ash has wide use in highway construction, at the moment it is especially being used as replacement of primary raw materials – soil, sand and gravel-sand. It can be used for highway structures (motorways, highways, busy town roads, airports, parking areas and mountain and country roads) for stabilized base layers of road, flowable fills, in structural fills/embankments, for soil improvement and grouts for pavement subsealing. The development of these new specifications and tests (when fly ash is used in concrete construction for transport infra-structure) leads to reduction of materials related problems. Additionally the rational tests based on documented research prove that the increase of the fly ash utilization provides a net of environmental benefits as well as many of economic benefits. Partial cement replacement with supplementary cementing materials reduces greenhouse gas emission proportionately and results in a more "green" concrete, through reduced energy consumption (energy required to produce cement) and prevents the depletion of natural resources.

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# VARIOUS METHODS OF PRODUCING ELECTRICITY FROM BIOMASS

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Abstract: The purpose of this paper is to present modern technologies used to produce electricity using biomass. Description of important technologies which allows the optimal use of biomass resources is given. Article shows many ways to maximize the energy potential which is hidden in the biomass. In the following sections examples of power plants are given, and particular analysis of the main technologies used to generate energy from biomass.

Keywords: renewable energy, biomass energy, biomass gasification, combustion of biomass.

## 1 Introduction

Biomass, a renewable energy source, is biological material from living, or recently living organisms, such as wood, waste, (hydrogen) gas, and alcohol fuels. Biomass is commonly plant matter grown to generate electricity or produce heat. In this sense, living biomass can also be included, as plants can also generate electricity while still alive. The most conventional way in which biomass is used, however, still relies on direct incineration. Forest residues, for example (such as dead trees, branches and tree stumps), yard clippings, wood chips and garbage are often used for this. However, biomass also includes plant or animal matter used for production of fibers or chemicals. Biomass may also include biodegradable wastes that can be burnt as fuel. It excludes such organic materials as fossil fuels, which have been transformed by geological processes into substances such as coal or petroleum [1].
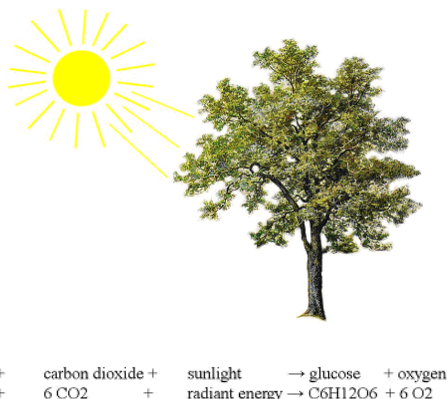


| water + | carbon dioxide + | sunlight | → glucose | + oxygen |
| $6\ H_2O +$ | $6\ CO_2$ | + radiant energy | $→ C_6H_{12}O_6$ | $+ 6\ O_2$ |

Fig. 1. Chemical process of photosynthesis, source: own

## 2 Classification of biomass energy

Thermochemical:

a) Direct combustion for immediate heat. Dry homogeneous input preferred.

b) Pyrolysis. Biomass is heated either in the absence of air or by the partial combustion of some of the biomass in a restricted air or oxygen supply. The products are extremely varied, consisting of gases, vapours, liquids and oils, and solid char and ash. The output depends on temperature, type of input material and treatment process. In some processes the presence of water is necessary and therefore the material need not be dry. If output of combustible gas is the main product, the process is called *gasification*.

c) Other thermochemical processes. A wide range of pre-treatment and process operations are possible. These normally involve sophisticated chemical control and industrial scale of manufacture; methanol production is such a process, e.g. For liquid fuel. Of particular importance are processes that break down cellulose and starches into sugars, for subsequent fermentation.

Biochemical:

a) *Aerobic digestion*. In the presence of air, microbial aerobic metabolism of biomass generates heat with the emission of CO2, but not methane. This process is of great significance for the biological carbon cycle, e.g. decay of forest litter, but is not used significantly for commercial bio-energy.

b) *Anaerobic digestion*. In the absence of free oxygen, certain micro organisms can obtain their own energy supply by reacting with carbon compounds of medium reduction level to produce both $CO_2$ and fully reduced carbon as $CH_4$. The process (the oldest biological "decay" mechanism) may also be called "fermentation", but is usually called "digestion" because of similar process that occurs in the digestive tracts of ruminant animals. The evolved mix of $CO_2$, $CH_4$ and trade gases is called *biogas* as a general term.

c) *Alcoholic fermentation.* Ethanol is a volatile liquid fuel that may be used in place of refined petroleum. It is manufactured by the action of micro-organism and is therefore a fermentation process. Conventional fermentation has sugars as feedstock.

d) *Biophotolysis.* Photolysis is the splitting of water into hydrogen and oxygen by the action of light. Recombination occurs when hydrogen is burnt or exploded as fuel in air. Certain biological organism produce, or can be made to produce, hydrogen in biophotolysis. Similar results can be obtained chemically, without living organism, under laboratory conditions.

Agrochemical:

a) *Fuel extraction.* Occasionally, liquid or solid fuels may be obtained directly from living or freshly cut plants. The materials are called exudates and are obtained by cutting into (tapping) the stems or trunks of the living plants or by crushing freshly harvested material. A well known similar process is the production of natural rubber latex. Related plants to the rubber plant *Herea*, such as species of *Euphorbia*, produce hydrocarbons of less molecular weight than rubber, which may be used as petroleum substitutes and turpentine.

b) *Biodiesel and esterification*. Concentrated vegetable oils from plants may be used directly as fuel in diesel engines; indeed Rudolph Diesel designed his original 1892 engine to run on variety of fuels, including natural plant oils. However, difficulties arise with direct use of plant oil due to the high viscosity and combustion deposits as compared with standard diesel-fuel mineral oil, especially at low ambient temperature (\< ~ 5°C). both difficulties are overcome by converting the vegetable oil to the corresponding ester, which is arguably a fuel better suited to diesel engines than conventional (petroleum-based) diesel oil [2].
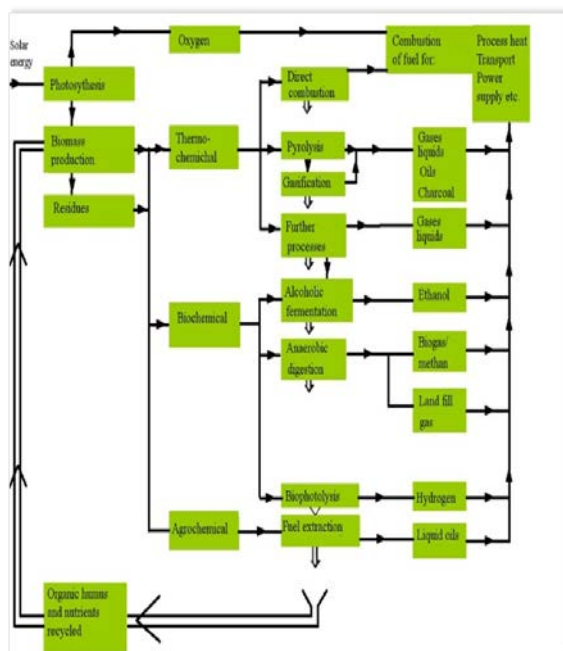
Fig. 2. Biofuel production processes, source: own based on [2]

**3 Wood biomass**

Wood biomass includes wood chips from forestry operations, residues from lumber, pulp/paper, and furniture mills, and fuel wood for space heating. The largest single source of wood energy is "black liquor," a residue of pulp, paper, and paperboard production. Burning wood is nothing new, it is the most common form of biomass. For thousands of years people have burned wood for heating and cooking. Wood was the main source of energy in the world until the mid-1800s. Wood continues to be a major source of energy in much of the developing world. In the United States many manufacturing plants in the wood and paper products industry use wood waste to produce their own steam and electricity. This saves these companies money because they don't have to dispose of their waste products and they don't have to buy as much electricity.

**4 Biomass gasification**

There are several widely used process design for biomass gasification:

a) staged reformation with a fluidized-bed gasifier (the biomass is first pyrolyzed in the absence of oxygen. Then the pyrolysis vapors are reformed to synthesis gas with steam, providing added hydrogen as well as the proper amount of oxygen and process heat that comes from burning the char).

b) staged reformation with a screw auger gasifier (moisture and oxygen) is introduced at the pyrolysis stage, and process heat comes from burning some of the gas produced in the latter.)

c) entrained flow reformation (external steam and air are introduced in a single-stage gasification reactor)

d) partial oxidation (uses pure oxygen with no steam, to provide the proper amount of oxygen. Using air instead of oxygen, as in small modular uses, yields produce gas (including nitrogen oxides) rather than synthesis gas [3].

Biomass gasification is also important for providing a fuel source for electricity and heat generation for the integrated biofinery. Virtually all other conversion processes, whether physical or biological, produce residue that cannot be converted to primary products. To avoid a waste stream from the refinery, and to maximize the overall efficiency, these residues can be used for combined heat and power production (CHP). In existing facilities, these residues are combusted to produce steam for

power generation. Gasification offers the potential to utilize higher-efficiency power generation technologies, such as combined cycle gas turbines or fuel cells. Gas turbines systems offer potential electrical conversion efficiencies approximately double those of steam-cycle processes, with fuel cells being nearly three times as efficient . A workable gasification process requires development of some technology: for example, feed processing and handling, gasification performance improvement, syngas cleanup and conditioning, development of sensors, analytical instruments and controls, process integration, and materials used for the systems [3].

**5 Waste and residues**

Municipal Solid Waste and Biogas - there are about many landfills that recover methane, which forms as waste decomposes in low-oxygen (anaerobic) conditions. The methane is burned to produce electricity and heat. Wastes and residues from human activity and economic production are a form of "indirect" renewable energy, since they are unstoppable flows of energy potential in our environment. Wastes and residues arise from:

a) primary economic activity, e.g. forestry, timber mills, harvested crops, abattoirs and food processing

b) urban, municipal and domestic refuse, including sewage

The energy generation potential from such wastes is primirily from the biomss content. However, there is usually a significant proportion of combustible waste from mineral sources, e.g. most plastics; such combustion requires regulation to reduce unacceptable emissions. A key factor regarding wastes and refuse is that they are usually available at points or concentration, where they easily become an environmental hazard. Dealing with this problem becomes a necessity [4]. Major waste are:

a) municipal solid waste (MSW) – wastes removed by municipal authorities from domestic and industrial sources it usually contains significant amounts of metal, glass and plastic material. Recycling of most plastics, metal, glass and other materials should occur before landfill or combustion. Nevertheless, non-biomass materials usually remain in significant amounts. MSW is loose, solid material of variable composition, available directly for combustion and pyrolysis. If the composition is acceptable, it may be pressurised and extruded as "refuse derived fuel, RDF", usually available as dried pellets of about 5 cm dimension for combustion in domestic-scale boilers

b) Landfill and sewage – usually MSW, waste deposited in large pits. A large proportion of MSW is biological material which, once enclosed in landfill, decays anaerobically. The process is slower than in most biogas digesters because of the reduced ground temperature, but when stabilised after many months the gas composition is similar. If not collected, that gas leaks slowly into the atmosphere, along with various smellier gases such as H2S, so causing unpleasant environmental pollution. Therefore, the landfill site should be constructed and capped, e.g. with clay, so the gas can be collected when the pit is full, e.g. by an array of perforated pipes laid horizontally as the landfill is completed or drilled vertically into the buried refuse of an existing site. Regulations in several countries require capture of at least 4-% of the methane from landfill, on order to reduce greenhouse gas emissions. Even without monetary credit for the greenhouse benefits, it is usually profitable to capture and utilise landfill gas if there is an industrial facility nearby which can use the fuel for direct combustion in boilers or engines for process electricity and heat generation. Faced with limited landfills, many municipalities have reduced the amount of landfill per household by obliging households to separate much of the biological material that previously went to landfill, e.g. garden clipping and horticultural compost by chopping and aerobic digestion [5].

## 6 Combustion of biomass: Co-firing

Co-firing of biomass is mainly performed in coal-fired power plants using the Pulverized Fuel (PF) technology. PF plants pre-treat the fuel by grinding/pulverizing it to small particles. These particles are injected in the steam boiler via combustors. Mainly woody biomass is used for co-firing in PF power plants. Bone dry woody biomass shows satisfactory grindability characteristics. The percentage which can be co-fired is limited due to fouling, agglomeration and corrosion. This is caused by ash composition in connection to the sulphur, chlorine, and phosphorous content of the biomass. The injection of biomass can be either separate from the coal (dedicated combustor) or together with the coal (using the same combustor). Another option is to fire the biomass in a separate boiler, but it is rather an exception than common practice. Typical co-fire percentages in Europe range from 2 to 7% regardless of the installations capacity**.** In Europe many power plants have significant experience with co- firing biomass. Statistics on the amount of biomass in Europe are inconclusive and should be estimated: It is reported that 3.5 million tons of coal are replaced by biomass co-firing in 2004 worldwide. Based on the fact that 100 of the 150 plants with co-firing experience are in Europe, the substituted amount of coal in Europe is estimated to be 100/150*3.5 = 2.3 million tons of coal. With an average electric efficiency of 35% and a caloric value for coal of 4.17 MWh/ton, the electricity generated by co-firing of biomass in coal-fired power plants in EU27 is 9.5 TWh per year. Co-firing percentages range from one percent up to about 20% (on energy basis). Currently, a percentage of 3–5% is most common in Europe. The co-firing percentage is mainly dictated by the coal mill capacity. Since the grindability of fine and dry material is superior to more fibrous and wetter material, wood pellets can be co-fired in higher percentages than wood chips of agricultural residues. Most power plants have boiler capacities ranging from 100 to 750 MWe. Major countries in co-firing are currently Germany, Finland and the UK. A wide variety of biomass materials, including herbaceous and woody materials, wet and dry agricultural residues and energy crops are used.

## 7 Combustion of biomass: large scale power and CHP

Solid biomass is combusted in a furnace. The flue gas heats water, generating pressurized steam in a boiler. The steam is expanded in a steam turbine where the thermal energy is converted into mechanical energy. To close the water loop, steam condenses, is re-pressurized and returned to the boiler. The steam turbine drives a generator. The electricity from the generator is commonly supplied to the (national) grid. Besides electricity, heat is generated. When this heat is utilized, a CHP-system is created. The heat/power-ratio can, within boundaries, be justified with by the end pressure of the steam expansion. Alternatively, the heat can be utilized without making electricity. In this case, heat from the flue gas is used to make hot water or steam. This can be utilized for several purposes in the build environment (district heating) or industry (process heating). Several types of furnaces are applied. The choice for a furnace type is mainly determined by the feedstock. Many feedstock types require a pre-treatment prior to combustion. Common pre-treatments are size reduction (e.g. chipping of wood) or drying. Flue gas cleaning is in almost all cases required. The complexity of the flue gas cleaning is determined by the feedstock and legislative flue gas requirements. Most flue gas cleaning systems result in a lower overall efficiency. Fly ashes and bottom ash can be recycled to the place of origin, be disposed as waste or can, in some cases, be processed in concrete and cement industry or be utilized as road construction material. The type of application depends mainly on the feedstock and the furnace configuration.

## 8 Combustion of biomass: waste incineration

A special case of biomass combustion is waste incineration. The technologies used are similar to biomass combustion, however, special pre- and after-treatment is required since the fuel composition of waste fluctuates in time, contains more pollutants and is fluffier in morphology. Only grate-fired technologies are

applied in waste incineration. Optimization of combustion technology and fuel properties is not possible due to the varying composition of the fuel (waste). Compared to dedicated biomass plants, waste incineration plants have larger capacities. The heat that is generated in waste incineration plants is used to generate steam that is commonly used for the production of electricity by steam turbines. In some cases, heat is utilized as well. Waste incineration plants only utilizing heat are uncommon. Based on the Dutch average waste composition, about 600 kWh electricity is produced per ton of waste. The availability of waste incineration plants is typically 90 – 92%. Since waste consists of biological material and materials with a fossil origin, not all electricity produced from waste is 'green'. Only the combustion of the organic fraction of waste generates green electricity. In the Netherlands, the average biogenic fraction of waste is periodically determined and the fraction of electricity that is considered green is based on that.



Fig. 3. Waste incineration plant, Amsterdam, Netherlands, source: ECOFYS

The first waste incineration plant on the site in Amsterdam was commissioned in 1993, had an electric efficiency of 21%, and processed about 765.000 ton MSW per year. Throughout the years, the capacity and efficiency have increased from 765 kton to 850 kton and from 21 to 22% respectively. In 2008, a new, improved waste incineration plant was commissioned at the same location, referred to as "High Efficiency-plant". This state of the art water-cooled grate fired plant generates electricity with a gross efficiency of 34% and a net efficiency of 30% which is significantly higher than the 22% gross efficiency of the 'old' plant (still in use). The steam temperature and pressure are 440°C and 125 bar instead of the more common 400°C and 40 bar. The capacity of the new plant is 530.000 ton of waste per year. Heat is delivered to nearby industry. In the future, heat will be supplied to a heat distribution grid for residential heating. The project was budgeted on 370 M€ however, the actual investment was at least 25 M€ higher. The annual turnover is 110 million Euros.

## 9 Digestion of biomass: manure digestion

Manure is fed to an anaerobic (without oxygen) reactor, the digester, where it is converted into biogas by bacteria. Most digesters are stirred tanks, but plug-flow digesters are used as well. Most reactors are operated at a temperature level of around 35 C. This is the so-called mesophilic system. Systems at a higher temperature level (55 C, thermophilic system) are used as well. The residence time in digesters is typically in the order of 30 days, which makes the equipment rather large. Biogas contains 55 to 70 vol-% methane; the remaining part is carbon dioxide with small amounts of other gases such as hydrogen and hydrogen sulphide.

After removal of moisture and hydrogen sulphide (if necessary), the biogas is fed to a gas engine. The engine drives a generator. The electricity from the generator is commonly supplied to the (national) grid. Waste heat from the engine cooling is used for maintaining the required temperature in the digester. The remaining solid material after digestion is called digestate.

Digestate is used as fertilizer and has, compared to undigested manure, an added value as fertilizer. To improve the biogas efficiency, so- called co-substrates are often added to the digester. This can be dedicated energy crops such as corn, but often waste products from food industry are used.



Fig. 4. Manure co-digestion plant, Beltrum, Netherlands, source: ECOFYS

**9 Conclusions**

In the previous paragraphs, major biomass technologies were discussed. It is very important to constantly develop and improve them. Biomass energy is locally available energy source with the highest versatility among the renewable energies; that is to say, it can be made available in solid, liquid or gaseous forms. No other energy source can open such a new opportunities for agricultural and forest development, additional jobs and enhanced rural infrastructure. It is not by chance that bio-energy development is gaining momentum in many countries, both developing and industrialized. Globally there is a growing confidence that RES in general is maturing rapidly in many areas of the world and not just in niche markets. It is important to recognize that the development of biomass energy will largely be dependent on the development of the RES industry as whole, as it is driven by similarly energy, environmental, political, social and technological considerations.

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# APPLICATION OF AUTOMATION AND ROBOTICS IN CONSTRUCTION WORK EXECUTION

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Abstract: In this paper are in particular presented the results of the survey on the usage of automation and robotics technologies in construction work execution by Slovak contractors. The results of the questionnaire developed within the survey pointed out some notable aspects in terms of the current usage of automation and robotics systems in the Slovak construction industry and offered some implications related to the future advance in this scope within the country. Moreover, the paper mentions the benefits of automation and robotics technologies application during construction work execution and in brief gathers the factors that form barriers to more substantial use of the technologies in the sites.

Keywords: automation, robotics, automation and robotics technologies, construction industry, construction site, construction work, on-site construction

## 1 Introduction

In construction, the scope for automation and robotics technologies implementation can be fairly broad, including all stages of the construction life-cycle, from the initial design, through construction of the building on site and building maintenance or control after the building has been completed to the eventual dismantling or demolition of the building. This would encompass the use of automation and robotics technologies in all stages of construction, from the automation of the design process through the use of Computer Aided Design, the production of cost estimates, construction schedules and project management through the use of costing and planning software to actual ingenious machines that use intelligent control during on-site operations. The degree of automation and robotics systems implementation in construction varies significantly from one construction phase to another.  Readily, automation of design through the use of CAD is highly commonplace nowadays, unlike the use of automation systems or robots for on-site operations.

The most significant benefits of robotics and automation systems application in construction industry are [1]: enhancing productivity and work efficiency with reduced costs, solid quality with higher accuracy than that provided by skilled workers, occupational safety enhancement for workers and better safety for the public by deploying machines for dangerous works, work environment conditions improvement in that common manual work is reduced to a minimum, the workers are discharged from uncomfortable work positions, etc.

## 2 Automation and robotics in on-site construction work

The construction of any building includes different stages of construction processes from earthworks, through construction of structure (concreting, frames assembly, walling ...) to finishing works. Traditionally, the applied construction technologies within these stages are known as labor intensive and conducted in various dangerous situations. Moreover, problems relating to instability of labor force supply and the increasing labor costs are surfacing in the construction industry. It is desirable to lower the level of labor force dependence and increase efficiency by applying a specialized automation in construction sites. Hence, several researchers have intensively searched for suitable ways to introduce automation and robotics into construction sites.

As to the range of automation and robotics applications in construction sites, construction robots and automation include three categories: enhancement to existing construction plants and equipments, task specific robots, and intelligent or cognitive machines [2]. Enhancement to existing construction plants and equipments can be realized through the attachment of sensors and navigational aids, so as to provide improved feedback to the operative. Once the machine is placed in position in front of its

work area, digging and placing of spoil can be done automatically through the addition of sensors and controls that enables program-controlled operation.  Laser controls and ultrasound is commonly used. Task specific, dedicated robots, mostly developed in Japan, generally work under tele-operation or program control. The robots perform a specific, well defined task, but adaptation to other tasks is generally not possible. They are commonly used within a specific area of the construction process. There are several examples and can be divided into these categories: robots for structural work (e.g. concrete placing, steelwork lifting and positioning, ...), robots for finishing or completion work (e.g. exterior wall spraying, wall or ceiling panel handling and positioning, ...), robots for inspection works (e.g. external wall inspection) and robot for maintenance work (e.g. window and floor cleaning). Intelligent or cognitive machines present the least developed category, most are still under research. It is likely that if the machines of this type were developed, it would be a convergence of the technologies from two categories described above.

In Europe [3], most of the research efforts in the UK have predominantly been in the universities, with Reading (design for automation), Imperial College (simulation of jointing), City (masonry laying), Lancaster (excavation), Portsmouth (wall climbing) and the West of England (wall climbing) active to varying degrees. German efforts are mostly on enhancement to plants and equipments used in concreting. At the Robotics Lab in Spain, the research and development activities in the field of automation and robotics in construction industry started in the early 1990s. Several industrial projects related to the automation of pre-fabrication of glass-fibre reinforced concrete parts manufacturing were developed, dealing with the robotic spraying of panels and the optimization and rationalization of the whole factory, involving panel transport and storage. Other recent research that has taken place in Europe includes the control system for a semi-automatic façade cleaning robot and user oriented interactive building design in Spain.

### 2.1 Implementation of automation and robotics technologies in on-site construction process

Automation and robotics in construction work execution has various advantages that could help the implementation of these systems [4]. Among the most meaningful advantages belong:

i. less dependency on direct labour – fewer problems related to quality and the repetitiveness of work carried out, as well as costs may be reduced by reducing labour, whereas less operators are needed for the automated system;

ii. productivity increase – besides the speed of production increasing the productivity is improved by disengaging the operation of the limitations of the human factor;

iii. occupational safety increase – the automated systems may carry out their work in dangerous zones for humans, this makes it possible to reduce labour injuries;

iv. quality increase – operations with automated and robotized systems are typically carried out with less variability than human workers;

v. greater control over the productive process – problems may be detected in an easier was as each stage of the process is controlled in order to verify the correct functioning of the system and the result of each one;

vi. greater control over the final result of the process – the final result may be controlled in a more efficient way by controlling the result of each step of the aforementioned process.

Robots are primarily intended and developed for the sectors in which poor labour conditions prevail and in which a decreasing of the load is prospective. The high frequency of working injuries as well as the high statistics of work-related sickness in the building industry is an indication for the special requirements. Robot systems should take over the task of

handling heavy loads, of performing dangerous or dirty work or of working at hardly accessible locations and in ugly physical positions. Above all robots should function as tools of the human being. They are to be developed as intelligent tools and must not force the human being to the limits of working activities. It must be possible to integrate the robot systems into labour procedures. These must not disturb the existing communications structures and cooperation, for example, within the scope of a crew. Robot development should therefore be implemented together with those persons who will operate these systems at the building site at a later point of time. Changes in the labour environment and labour organisation by the application of robot systems must be at least oriented to the working people in the first step and then in the second to technology. An important aspect is high system flexibility to adapt the robots to the prevailing structures. Fully automatic systems are therefore only suitable in exceptional cases, for examples in areas with high safety risk. Unlike, semi-automated machines can be flexibly monitored and applied. The focus of development must therefore lie on semi-automated systems. Other industrial sectors have in the mean time also withdrawn from the aim to achieve inappropriate full automation. Semi-automated systems are by far cheaper and more flexible than fully automatic systems. They can be applied by small-sized and medium-sized construction companies to improve their competitiveness.

**2.2 The factors restraining the automation and robotics systems implementation in the construction sites**

The barriers to construction automation and robotics are major for on-site construction when comparing to other construction phases. Use of automation technology in design and planning management of construction projects is preferred. Automation technologies such as software used in these early stages of construction to improve efficiency are noticeably cheaper and readily available compared to automation and robotics technologies used in on-site operation.

One of the main obstacles for robotics implementation within the sites is the variability of construction processes and the variable conditions of construction environment. Unlike other industries, in the construction the form of processes execution may vary significantly between two different construction sites. Executing the same operation in different construction sites depends on various factors that influence its possible automation. The difference of the materials employed in the execution of an identical process implies the use of tools adequate for each material. The processes that form a constructive activity relates on the type of material and the tools used. The process flow may vary for the same activity if one of these two elements varies. The complexity of the installations for automation due the very low level of standardization is obvious.

An automated construction site can face more difficulties, such as technological and economical. The technological barriers are that a robot must cope with the complexity of the construction process implying a very dynamic and naturally evolving site, together with the need for performing multiple tasks with differing characteristics. With reference to [5 and 6] the barriers to the implementation of automation and robotics in construction sites may be outlined into these groups: economic and cost, structure and organisation of the construction industry, features of construction product and work processes (mainly uniqueness and complexity), technology (the nature of the construction work processes itself), and culture and human factor. These categories may be presented mainly by:

i. high investments are needed to incorporate the technologies,
ii. the work place is not static, construction sites are too much dynamic and unstructured, construction methods can be too complicated for robots and need for more mobile robots for transport and lifting of heavy components,
iii. there are frequent changes or advances in automated technologies and users have difficulty in keeping up with the changes,

iv. construction sites are usually unique and do not present the same set of problems; construction is a diverse industry and must to cope with an almost unique set of circumstances on each project and site,
v. temporary works and weather impact is substantial, etc.

**3 Methodology and results of the survey on the usage of automation and robotics systems by Slovak contractors**

In order to ascertain the present level of automation and robotics technologies implementation among Slovak building contractors, the analysis of the data collected in the survey was made. It was accomplished through the questionnaire survey, so the information on the use of automation and robotics technologies by the sample group is obtained. The type chosen was a closed questionnaire, several potential responses were ready entered, and respondents were requested to choose one or more responses. In order to avoid rigidity of available responses, an "other" and "specify please" was included in the choice of answers in some cases of questions.

There were 66 responses out of the 300 questionnaires sent out, which translates to a response rate of 22%. The respondents were given the option of responding through web application, the questionnaire was unpretending, designed to be as user-friendly as possible, respondents were required to scroll down, click and point to select the appropriate responses for each question. The web application reference was sent to construction enterprises from all around the country. It was sent with an accompanying letter introducing the investigation, brief stating the background and objectives of it and with confidentiality statement.

The first five questions were developed to reach the background information regarding the questionnaire participants, including number of full time staff, gross annual revenue, length of the company practice in the Slovak construction market, type of construction processes which they have operated and countries where they have participated in construction projects.
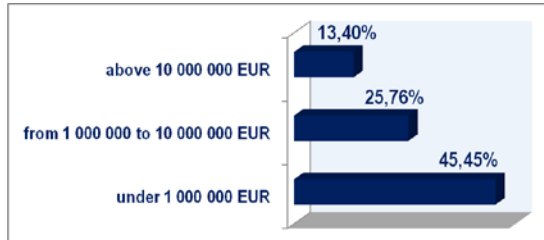
The responses on the question (Graph 1) related to the number of the staff could at first sight designate that "only" small and medium companies (89,4% together) have provided the answers in the investigation. This flows from the organizational structure of the Slovak construction industry, where from around ten thousand enterprises, only twenty-two are the companies with more than 249 employees. So the satisfying fact is that almost a third of big enterprises existing in the Slovak construction market has participated the survey.
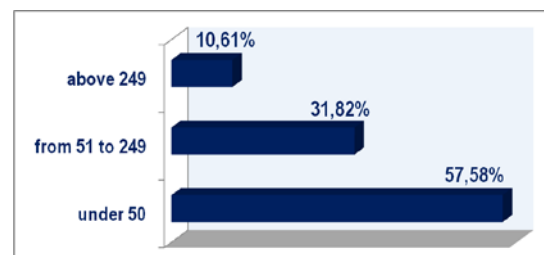


Graph 1 The number of full time staff in the company

As illustrated in the bar chart bellow (Graph 2), the gross annual revenue of the majority of the respondents (45,45%) is less than 1 million EUR. Although not all the respondents have answered this question (approximately 15 % not answered), their questionnaires were included to evaluation as the goal of the survey was to obtain information about usage of automation and robotics technologies in the sites and this question was just one from "additional" questions aiming to recognize the profile of respondents. On the other hand, this information could be substantial in consideration about automation and robotics implementation within the company works. It is well known that the construction industry is indeed price sensitive towards automation and robotics technologies application. The costs usually present a significant factor in deciding on technologies

implementation. Consideration regarding the costs involves not only buying costs, but also the technologies maintenance costs and level of efficiency and productivity enhancement. The bigger companies (especially those with more branch offices) usually have the monetary capacity to acquire the technology, they can afford it (the buying costs, the costs of updating) as their profit base is much greater compared to a smaller company. They may even get return for the technology acquired if it is used many times.



Graph 2 The gross annual revenue

The responses on the question related to the length of the company practice in the Slovak construction industry market (Graph 3) indicate that most respondents are not absolute beginner in the market but they were developed after the period of socio-economical changes in the country related to the year 1989.
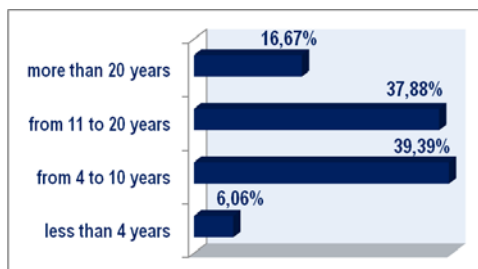


Graph 3 The length of the company practice

The majority of the companies involved in the survey (Graph 4) participate as contractor or subcontractor exclusively in construction projects within the Slovak territory. Let us assume that the companies that operate internationally on a global scale should more use automation and robotics technologies compared to those operating only locally. If a company would be successful in global market sharing and thus must compete with companies from all over the world, taking up of innovative technologies is almost inevitable. Moreover, the company sharing not only local market can afford to acquire the technologies, as it gains economies of scale by using it repetitively throughout its numerous construction projects. However, transporting of a piece of big high-tech equipment between projects can be expensive. That should not be a problem, if the automation or robotics technology is of relatively small size and mobile.
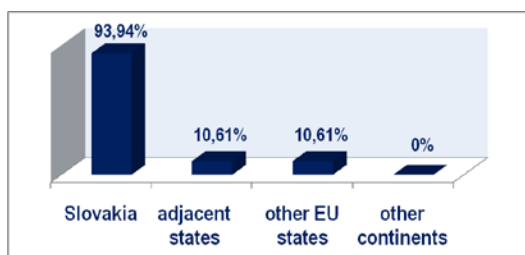


Graph 4 The countries in which the companies participated in construction projects

In the bar chart bellow (Graph 5) is presented the type of construction works that the companies usually execute in the

sites. Naturally, the respondents could choice more than one option. Following the results, we can state that a great number of the enterprises included in the survey usually perform almost all the construction works typical for most construction project.
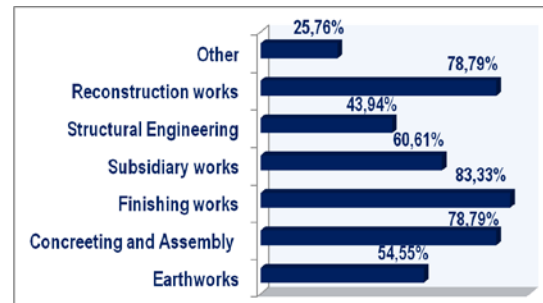


Graph 5 Type of construction works executed by the company

The most essential question of the survey (Graph 6) divided the respondents into two main groups. In the first group are the companies that are actually using some automation and robotics technologies during construction works (marked as „YES"). However, many more companies came under the second group, as they noticed that they: i) are not using any automation and robotics technologies and are not decided to use it in the near future (marked as „NO"); ii) are not actually using any automation and robotics technologies, but they had applied it some years ago (marked as „NO NOW, HAVE EXPERIENCE") and iii) are not actually using any automation and robotics tehncologies, but they are resolved to implement it in the near future (marked as „NO NOW, MAYBE IN THE FUTURE"). More than seventy percents of respondents have never used any automation and robotics technology.
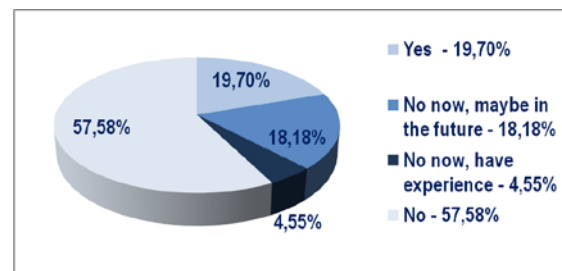


Graph 6 Usage of automation and robotics technologies in on-site construction

In order to confirm the hypothesis that larger companies operating on a global scale use the automation and robotics technologies (ART) more when comparing to small companies, the relation between the company size (relating to the number of employees) and the usage of automation and robotics technologies in on site construction is presented in the Graph 7. As expected, the majority of large enterprises implemented automation and robotics in its operation in the site whereas the technologies usage in small companies is not in contemplation ever. This probably relates with low awareness of automation and robotics benefits within small enterprises owners.
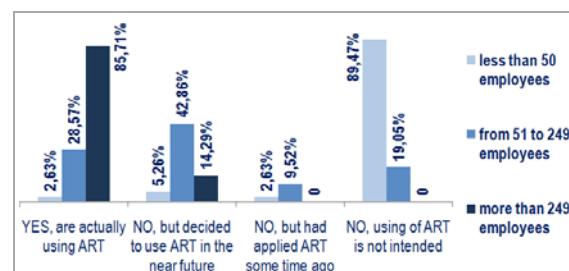


Graph 7 Relation between the size of the company and the usage of automation and robotics technology

The following question (Table 1) was answered only by respondents which in the past question introduced that they have never used any automation and robotics technologies ("No" and "No now, maybe in the future", together 75,76% respondents). They were requested to specify the barriers that discourage them to apply some innovative automation and robotics technology in the practice. Naturally, the respondents could indicate more than one from offered answers. The results indicate that respondents find costs of the technologies (74%) and low availability (68%) as the main hindrance to adopting these technologies in their companies. The one third of respondents (33%) is of the opinion that the automation and robotics technologies could not involve higher effects of their operation in the sites. Acceptance by the workers and by the company management (6%) is not seen as very significant in creating barriers to implementation.

**Table 1** The barriers discouraging the contractors to implement the automation and robotics technologies

| The factors that make difficult for implementation on automation and robotics technologies | |
|---|---|
| missing information (low awareness) | 22 % |
| high acquiring, maintenance and updating costs | 74 % |
| incompatibility with current practices and construction operations | 40% |
| difficult to use and not easily understood (low technology literacy) | 21 % |
| unavailable locally (difficult to acquire) | 68 % |
| not accepted by workers and by the management (untrustworthy) | 6 % |
| no effective to use | 33 % |
| other | 12 % |

Some automation and robotics technologies intended on on-site application are not easily understood. The barriers to use these technologies may be psychological as well, people do not want to use something what they do not understand and many people think that the technologies are difficult to use. Moreover, most contractors are confident that automation suit to repetitive and standardized work processes or areas where standard components are used, best in prefabrication constructions.

In order to recognize the usage area (Table 2) and the reasons of usage (Table 3), only the respondents, which introduced in the most determining question that they are actually using or some time ago have applied the automation and robotics technologies, were in ongoing questions requested to designate the types of construction works in which they apply it and the reasons or benefits that encourage them to use it.

**Table 2** The usage area of automation and robotics technologies in on-site construction

| The areas of application of automation and robotics technologies in construction work | |
|---|---|
| Earthworks | 62,5 % |
| Concreting | 43,8 % |
| Assembly works | 31,3 % |
| Subsidiary works | 12,5 % |
| Finishing works | 37,5 % |
| Structural Engineering | 37,5 % |
| Reconstruction works | 6,25 % |

**Table 3** The benefits of automation and robotics technologies implementation in on-site construction

| The benefits of automation and robotics technologies in construction work | |
|---|---|
| The finance saving | 75,0 % |
| Less human labour | 93,8 % |
| Higher productivity - the time saving | 56,3 % |
| Quality increase | 31,3 % |
| Occupational safety improvement | 25,0 % |
| Less material disposal | 25,0 % |
| Higher construction steadiness | 62,5 % |

All the respondents in the survey were also invited to enjoy the chance to take their opinion (stand point) to the future trends and opportunities of construction automation and robotics in general, regardless of their position in the technologies using in the practice. There was the list of statements on future trends and opportunities for the implementation of construction automation and robotics technologies in our country that the participants could agree or disagree to. The automation and robotics users as well as these who have never tried to use these systems could denote just o ne from proposed statements that in the best way represent their own opinion in terms of increased use of automation and robotics systems within on-site construction process. Most statements were deduced from findings of similar investigations on this topic made by foreign researchers [1, 4 and 7]. In the Table 4 is presented how many percents of respondents appropriated the different statements on the future using of automation and robotics in construction and denoted the statements as the most accurate for ongoing ten years.

**Table 4** Statements on future trends of construction automation and robotics implementation in construction processes execution

| Statements on the future trends of construction automation and robotics in construction work | |
|---|---|
| There will be a significantly greater scale of automation and robotics technologies available for use in on-site construction process and will be many more easier to install and operate in the sites | 16,67 % |
| The automation and robotics systems will be more easily available across the country | 1,52 % |
| The range of construction enterprises using automation and robotics technologies will increase significantly in the coming ten years | 10,61 % |
| The using of automation and robotics technologies will provide companies to operate more efficiently and competitively in the industry | 60,61 % |
| There will be greater awareness of automation and robotics technologies within the construction industry community | 3,03 % |
| The automation and robotics technologies will be more affordable from buying, maintenance and updating costs point of view (also for small construction subjects) | 6,06 % |
| The automation and robotics technologies will be readily accepted by the workers and the companies managers or owners | 1,52 % |

From the Table 4 is evident that the big mass of construction contractors participated in the survey (61,61%) is confident that the implementation of automation and construction in the company operation within the sites could raise its competitiveness and the companies could operate with higher effects all at once. On the contrary, only few of respondents correspond with the statements related to prompt acceptation of automation and robotics technologies by construction workers and managers and they do not suspect that the automation and robotics systems will be more easily available across the country in ongoing years.

**4 Conclusion**

In the paper are mostly analyzed the results of the survey intended on assignation of the level of automation and robotics technologies implementation in construction works operation by Slovak contractors. The questionnaire developed within the survey has highlighted some important points regarding the implementation of automation and robotics in the construction industry within the Slovakia territory and some implications related to future movements in this scope within the country.

As regards the Slovak construction industry, it can be concluded that the usage of automation and robotics in on–site construction works is low. It is expected that the automation usage in the

design and scheduling or other planning is higher compared to on-site operation. From the survey resulted that only approximately one fifth of construction contractors currently use the automation and robotics systems in their operation in the sites, although the systems application could admittedly bring many benefits not only to the very company but also to the society, as a whole. The significant barriers to implementation are presented by high acquiring, maintenance and updating costs and by low availability in our construction industry conditions. The greatest barrier may be overcome through the widening of the construction companies operating market, to enable them to gain the economies of scale through the repetitive use of the technologies and also by encouraging more repetitive and structured work processes.

All the same, many notable foreign researchers [2] expect that it is unlikely that there will be improvements in the near future in terms of affordability and availability of automation and robotics technologies. According to them the improvements might be seen in other areas of construction such as design rather than in on-site applications. It is unlikely that the technologies development and increased range of use and flexibility would refer to on-site technologies. But an area relevant to on-site construction could be in the development of modular building designs that fully use off-site prefabrication, transport and assembly in the site.

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**Primary Paper Section:** J

**Secondary Paper Section:** JD, JN