



CER Comparative European Research 2021

Proceedings | Research Track

of the 16th Biannual
CER Comparative European Research
Conference

International Scientific Conference for Ph.D. students of EU countries

October 25-27, 2021 | London



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Introduction

The conference Proceedings you are holding is a collection of selected peer-reviewed texts presented at the international scientific conference Comparative European Research - CER 2021 (October 25-27, 2021).

The biannual international scientific conference is organized under the auspices of the SCIENCE scientific platform every March and October and follows up on activities aimed at providing greater support for the scientific activities of Ph.D. students and beginning researchers. The various biannual CER conferences represent a space for the international assessment of the qualitative standard of scientists and the results achieved by the various academic institutes. The CER conference is an ideal place for comparing the standard of scientific work, particularly on a European scale.

The Proceedings from the CER 2021 conference contains several dozen academic texts whose main purpose is the presentation and sharing of knowledge always in one of nine conference sections. The conference Proceedings prioritize only those articles which are good enough to offer readers new insights into the issues analyzed, or which extend the known boundaries of science. The guarantor of the CER 2021 conference is a signatory of the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities, and therefore all papers are made available to professionals and the general public via OpenAccess.

The conference committee, comprising experts from several university departments, believes that the CER international scientific conference will attract an ever wider base of participants to join in the discussions and will stimulate further scientific work and interdisciplinary development.

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THE IMPACT OF TRUST ON THE EFFECTIVE BUILDING OF SMART CITY APPROACHES

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Abstract: Trust is an important aspect of embracing changes and new concepts. Credible governance can help to build effectively Smart City approaches in collaboration with all stakeholders. The purpose of the article is to point out the positive impact of trust on the effective building of approaches and the reputation of Smart City. The aim is to identify the elements, capabilities of trustworthy management and how to effectively manage Smart City on the basis of trust supporting the city's reputation through three research questions. Within the article, data were obtained through methods of secondary analysis, comparison and summarization. The main output is the answers to the research questions and the proposed general model of effective management of Smart City through trust based on elements such as transparency, quality of information, communication, competence and credibility. Verification of the model in practice will be part of future research activities.

Keywords: trust; Smart City; reputation; management; sustainability

1. Introduction

The purpose of the article is to describe the impact of trust on the effective building of approaches and the reputation of Smart City. The aim is to identify the elements, skills of a manager and an effective way of managing Smart City principles based on the aspect of trust and reputation through three research questions. The results of the secondary analysis of literature and research studies form the basis for a general model of effective management of Smart City through trust. Research questions:

- What elements are necessary for building trust?
- What skills should Smart City management have?
- How is it appropriate to effectively manage Smart City on the basis of trust?

For the purposes of the article, the operationalization definition will be used, i. e. trust represents a positive attitude of stakeholders towards new Smart Cities technologies that reflect their needs, expectations and values, thus increasing the reputation of the selected Smart City.

2. Literature Review

2.1 Management on the principle of elements of trustworthiness

A trusted manager should build trust in the so-called five waves. First it is about his self-confidence and then he can trust others. Credible relationship building will contribute to strong trust throughout the organization, in the market and, ultimately, in society. If a trustworthy manager explains a new concept, strategy or concept correctly, people will understand the paradigm faster, identify with it more quickly (their behavior will shift through a change of thinking) and will support the new principles with their involvement and participation [4, 5]. According to Covey, the four basic elements of credibility include [4, 5]:

- integrity,
- intentions,
- competence,
- results.

These Elements can be represented through a tree model. Integrity is at the root of the trust system. Whether a person acts in accordance with his values is an internal factor. Intentions form a tribe as they are more clear. Competence is made up of talents, predispositions, communication style, leading others, knowledge and expertise that generate the potential to achieve results. The fruits of confidence-building represent results in the form of measurable outputs. All four elements are equally important, if one of them does not work, it will have a negative impact on the whole system [4, 5].

2.2 Aspect of trust in the Smart City concept

A city that uses smart technologies with the primary goal of improving the quality of life should be built on the principle of the expectations and needs of all stakeholders. The development and sustainability of Smart Cities depends on the value aspect of trust [3]. A closer understanding of the concept of trust is associated with elements of cybersecurity and privacy. A holistic approach defines trust as belief in valuable, relevant, consistent and reliable results [3]. In order to obtain benefits, it is necessary to create trust between the inhabitants and the strategic management of the city. For effective management of Smart City on the principle of trust, management should [3]:

- clearly define the vision, development plans and programs,
- raise financial resources for smart investments and innovations,
- encourage stakeholder collaboration through community building.

The results represent credibility, integrity, relevance, transparent information and consistency. Building trust depends on [3, 8]:

- understanding of Smart City frameworks,
- strengths and weaknesses, threats and opportunities of the city (SWOT analysis),
- identification and elimination of shortcomings in the area of trust through the personal commitment of the city's strategic government and its reputation,
- combining and supporting partnerships, internal and external sustainability development.
- the building blocks of trust for smart cities are compliance, finance, privacy and security.

2.3 Smart City reputation based on Trust Data

The adaptation, adoption and use of smart technologies are based on the principle of trust, which is closely linked to risk. The transfer of information between communities in Smart Cities generates the so-called a contextual integrity framework that works best within sociologically oriented credible cultures (eg Nordic countries such as Norway, Denmark or Sweden). Citizens in developed Smart Cities are characterized by a high level of awareness, experience with the use of technology or a positive approach to change [9].

A city with a positive reputation meets the specific conditions for building an explicit relationship between citizens and technology, including the creation and strengthening of digital skills in practice. The benefits will take the form of a trust and a positive reputation at global level [10].

An important element of the reputation of the city built on the principle of trust in the data is the so-called the concept of digital sovereignty of Barcelona citizens, who have the right to participate in public decisions and smart city governance, which supports the trend of centrist-centric Smart Cities [1].

3. Materials and Methods

Research studies from Edelman, YPO, APCO Worldwide, World Development Report were selected based on the following criteria:

- each study should reflect the essential elements that affect the level of trust,
- should be situated in the field of management, managerial styles and communication,
- the data should meet the conditions of high relevance, i. e. 2020.

In addition to the secondary analysis, the article also used the method of summarizing and comparing research studies and the literature base in the discussion section (Chapter 5).

4. Results

4.1 Edelman 2020 research study

According to an Edelman research study that has been conducted regularly for 20 years, the aspect of trust is important for all stakeholders as follows [6]:

- Citizens who trust businesses buy more, accept better change and new government action.
- Employees deliver better work results.
- Investors and regulators with confidence take greater risks .
- Trust supports market dynamics.
- The media disseminates information about trust among stakeholders, promoting awareness, image and competitive advantage.

The largest shift in the perception of trust took place between 2010 and 2020. Ten years ago, transparency of the information provided and performance in terms of results achieved were essential aspects for the development of trust, i. e. rather hard quantitative factors. Currently, soft soft skills such as competence and ethics through values, morality and sustainability are more important than in 2020 [6].

The global confidence index implemented in 2020 pointed to the fact that the highest level of confidence is achieved by Asian countries. Out of the total number of 26 places, China took first place, followed by India, Indonesia, UAE, Mexico, Singapore. Norway, Canada and Hong Kong have a neutral level of trust. Distrust prevails in Argentina, the countries of the European Union, the United Kingdom and Russia [6].

The category of informed public achieves an overall level of confidence on a 100-point scale of 65, high trust prevails between the population and business or non-profit organizations (70%), followed by the media (61%) and the last is the government (59%). The majority population has a much lower level of trust in all institutions. 55% of people trust business and non-profit organizations, 47% trust the government and the media. Another concern is the unpreparedness of the government for the future, t. j. The results show that 61% of people globally perceive the development of technology as too fast, 66% do not believe in the effective implementation of innovations in practice, which is related to Smart Cities, and 61% of government and strategic urban management do not understand technologies to regulate and manage them effectively. , implement and use. The driving forces of trust are ethics at 76% and competence at 24%. The level of overall trust results from integrity (49%), purpose (24%), abilities (24%) and reliability (15%) [6].

4.2 YPO research study

The group of managers belonging to the younger age category prefers management based on mutual trust in their style (96% of respondents). However, only 34% of them have a specific plan for building and stabilizing confidence. A key element for the successful

implementation of management trust in Asia is corporate culture, which can be a competitive advantage but also a major obstacle, elements such as transparency, communication, quality of information, clear goal and purpose are also prioritized. A survey of 2,960 young managers in 118 countries in 2019 shows a focus on managerial, people-centered approaches with the priority of ensuring the trust of all stakeholders [2].

4.3 APCO Worldwide Survey

The decisive factor that dynamizes the work environment is trust in managers. The results of a survey in the USA, in which 1 202 managers participated, show that only 32% of employees consider them trustworthy. Every third employee appreciates meeting managerial commitments and building trust.

Managers should be able to identify issues that reduce trust, fulfill their responsibilities, be responsible, prefer clear expectations, values and responsibilities [7].

4.4 World Development Report

The index compiled on the basis of the World Development Report in 2013 confirmed the positive correlation between trust and the involvement of the population in innovative projects (Figure). The degree of collective involvement is a measured quantifier of research activity.

Countries where a climate of trust prevails among the various stakeholders are more politically stable, accountable and lower in violence. If the level of trust is higher, then it is easier for citizens to accept change, they are more flexible, more adaptable and their participation rate is higher [11].

5. Discussion

From the results of the secondary analysis and research studies, it was possible to answer three research questions as follows.

5.1 What elements are necessary for building trust?

Common and different elements that form a necessary precondition for building trust in the Smart Cities concept according to the findings from the case studies in section 4.1. to 4.4. are found in Table 1.

Table 1 Elements of building trust

Element	Research study			
	Edelman	YPO	APCO Worldwide	World Development Report
Ethics	Yes	No	Yes	No
Competence	Yes	No	Yes	No
quality of information	Yes	Yes	No	No
readiness for change	Yes	No	No	Yes
Transparency	No	Yes	No	No
Communication	No	Yes	Yes	Yes
Credibility	No	No	Yes	Yes

Source: own processing according to case studies

Communication is a critical element of success in building trust. Credibility, competence and ethical behavior will prepare citizens for change, which they will accept more easily through quality information, i.e. j. creating awareness

5.2 What skills should Smart City managers have?

Effective management of Smart City should reflect elements of character and competence based on integrity, intentions, abilities and results. Trust cannot work without ethics and transparency related to the quality of information and communication. Credible management can simplify readiness for change and generate benefits for all stakeholders in the form of quantifiable results.

5.3 How is it appropriate to effectively manage Smart City on the basis of trust?

An essential part of the general model of effective management of Smart City on the basis of trust is trustworthiness, represented by a tree distribution inspired by Covey. The roots represent the internal factor of integrity, the visible part is the intentions and competence, measurable results are placed in the crown of the tree. Their interaction creates credibility that can be applied individually, collectively, organizationally or socially.

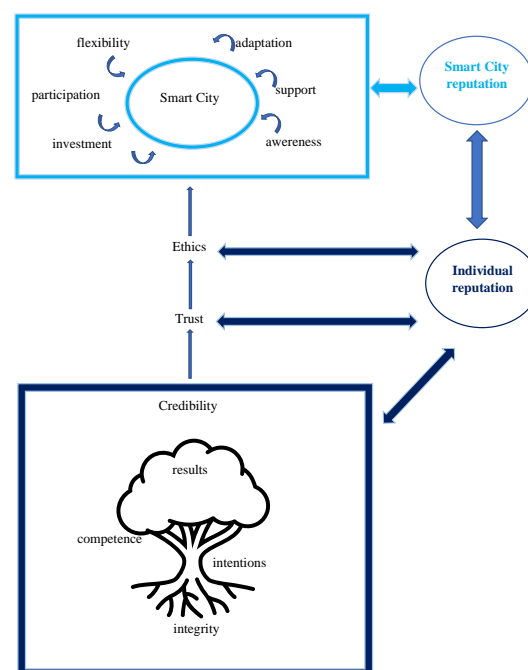


Figure 1: Description of figure no. 1

Source: own processing according to capitols 2. and 4.

The manager, resp. a person who has credibility, trust and ethics builds his own positive reputation. There is also feedback between the given elements, i.e. reputation strengthens the current level of credibility, trust and ethical behavior on an individual basis.

Credibility has a positive effect on building trust and a reputation that depends on ethics. Summarizing aspects has a major positive impact on the principles and concepts

of Smart City. Trust will ensure easier acceptance of changes, increased awareness of the issue, investment, participation and support of all stakeholders, adaptation and flexibility to innovative Smart Cities concepts.

Credible management, which generates trust between stakeholders, also has an impact on sustainable development, reputation management and the growth of Smart Cities in a global sense. The individual's reputation supports the reputation of Smart City, thus mediating the feedback of a model focused on effective management of the city on the basis of trust.

6. Conclusions

Building trust-based Smart City concepts can make it easier to embrace and adapt to change. Confidence in strategic management should be embodied by a trusted manager who is characterized by integrity, achieving results based on his competencies and fulfilling the set tasks.

The main finding of the article is that trust has a positive effect on Smart City concepts. According to relevant studies, the critical factors for the success of its support include:

- communication,
- competences and ethics.

The credible management of Smart City contributes to a higher individual and collective reputation, sustainability and competitive advantage of a particular city not only locally but also globally.

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SMART CITY CONCEPTS IN V4 COUNTRIES

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Abstract *The aim of the article is to identify the genesis and development of Smart City concepts in the V4 countries, that means The Czech Republic, Hungary, Poland and Slovakia. Within each country, those cities were selected that met the selected Smart City focus criteria in the V4 countries, information on cultural differences in the selected countries was available, and the selected case studies included models and strategies for managing the Smart City area. In addition to the secondary analysis, comparison and summarization methods were also used. The main finding is that the surrounding countries are more developed in the area of Smart Cities, which also achieves a higher level of reputation. They are also developing their concepts in rural areas and municipalities. Nitra, as the first Slovak Smart City, focuses primarily on mobility. Slovakia is beginning to address the concept of Smart City in the form of pilot projects and future strategies, especially in the time horizon until 2030. Other V4 countries represent the best practice for the development of Slovak smart cities in the future.*

Keywords: *Smart City, strategy, management, V4, benchmarking*

1. Introduction

In 2019, the Czech Republic, Slovakia, Hungary and Poland established cooperation in the field of implementation and support of pilot team projects in their cities and municipalities [14]. In general, the concept of managing "smart cities" is currently not widely used in municipalities, as the given territorial units have problems with infrastructure and several do not even have a sewerage system. The budget for the development of transport in the years 2014 - 2020 was set at up to 1.088 million euros. The largest financial amount was received by Hungary (321 million), 314 million was for Poland, followed by Romania, the Czech Republic and Slovakia [4].

2. Methodology

The method of secondary analysis through literature and case studies was used in the article. Criteria for selecting case studies included:

- focus on Smart City in V4 countries,
- information on cultural differences in selected countries,
- models and strategies for managing Smart City areas.

In addition, the method of comparison, benchmarking and summarization was used.

3. Results

3.1 Czech Republic

Smart Cities concepts in the Czech Republic are supported by the Ministry of Regional Development. Smart City projects are implemented through significant stakeholder participation, such as companies, universities or clusters. To support Smart Cities, was created so called Czech Smart City Cluster [3]. However, most citizens do not have sufficient information about the strategy of

sustainability and development of Czech regions and cities. The problem of ambiguity in the term "Smart City" among Czechs was also confirmed in the EON survey from 2018. The results pointed to the fact that only 19% of respondents out of a total of 1,500 respondents understand the term smart city and realize the benefits of technology for their lives and business. People living in larger cities are more open to new trends and have more technical information than residents of the surrounding municipalities. An interesting fact is that 50% of respondents did not say that they knew about any smart Czech city, for example they did not mention Prague or Brno [9]. Their age limit was set in the range from 25 to 34 years, which cannot be considered as the older generation. This makes the results more alarming and suitable for further research [11]. Prague has developed a strategy for sustainable development based on Smart City until 2030. The main coordinators of smart projects are the company Operator ICT in cooperation with the Institute for Planning and Development [1].

The strategic management of the city of Brno has outlined a smart strategy until 2050. The priorities for development are a higher quality of life and long-term sustainability. The document is currently in the development phase and will contain the set goals, ways to achieve them, monitoring, defining concepts, powers and responsibilities. The coordinator is the Brno City Commission. The sharing of best practice among European Smart Cities is realized through the Ruggedised project [1].

The strategic development plan of the city of Ostrava is created for the period from 2017 to 2023. The National Research Center develops innovative technologies for a higher quality of life and efficient use of limited resources. Citizen participation is ensured by collecting their creative ideas through the fajnOVA platform [1].

The comparison of three Smart cities in the Czech Republic (Prague, Brno and Ostrava) shows the following findings. Smart City Prague achieves on a scale from 0 to 5 points, the highest rating in smart government, business and quality of life. Opportunities for improvement compared to Brno and Ostrava can be found in the environment section in Figure 1 [1].

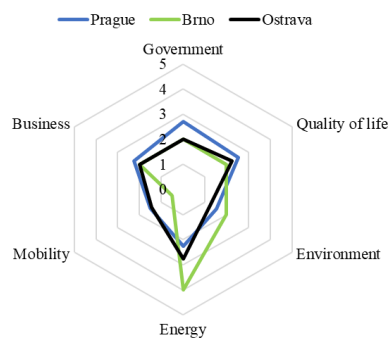


Figure 1: Benchmarking – Prague Brno, Ostrava
Source: own processing according to [1]

Brno excels especially in the field of providing the so-called "Green" energy and the environment. The lowest rating Brno achieved in the mobility section. Ostrava has a balanced score with Brno in the fields of business, government and quality of life and achieves the lowest rating in comparison with Prague and Brno in the part of the environment, and it does not create the best practice in any of the examined parts [1].

3.2 Hungary

Citizens need to have awareness and knowledge in order to recognize the fundamental differences between a intelligent city and a "smart city". The application of ICT between strategic management and people, their mutual communication and only local support represents a level of "intelligence". However, if urban development is based on vision, strategy, goals, sustainability, culture, change, transparency, efficiency and cooperation beyond the city or region, it is a smart approach [6]. A change of mindset and a positive attitude to change is thus a cheaper and more effective approach to the Smart City concept than an expensive modernization of current processes in the city / region [7]. The primary implementation problem is insufficient capacity for Big data analysis and weak basic technological infrastructure [1]. Hungarian cities are planning a strategy, the implementation of which will bring a unified national structure, cooperation of stakeholders, mediate the use of data and create a business model with greater transparency Smart Cities in the South [12]. The best practice in comparing smart cities in Hungary is the capital Budapest. The Smart City strategy is based on three pillars [1]:

- sustainability,
- technologies,
- social responsibility to protect limited resources.

On a score scale from 0 to 5, the environment received 2.9 points (Figure 2). The protection of scarce resources is implemented through an integrated energy strategy and water management [1]. The same point evaluation with the second compared city - Debrecen was achieved in the field of government and energy. Debrecen manages bottom-up government projects, the pillars of strategic development being primarily digital literacy, transport and energy [1].

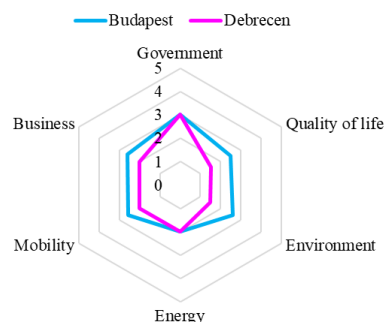


Figure 2: Benchmarking – Budapest, Debrecen
Source: own processing according to [1]

Key stakeholders include the municipality and the Center for Urban and Economic Development [1].

3.3 Poland

The principle of decentralization, fragmentation prevails in the management of Smart Cities in Poland and there is no uniform implementation strategy in the given area. A promising strategy for sustainable urban development has been set for the period 2030. The main pillars are [1]:

- higher quality of life,
- diagnosis of social and economic problems,
- digitization,
- mobility,
- improving air quality.

Participating parties include the Ministry of Investment and Economic Development, the Center for Innovation Opportunities and the Agency for Business Development, including universities and private sector support [1]. Within project financing, a conservative approach prevails, which is characterized by drawing free funds from green funds or state and regional budgets [1]. There are three Smart Cities in Poland that can be considered best practice, i. e. Warsaw, Łódź and Bydgoszcz. The strategic development of Warsaw is planned for 2030, the financial coverage is forecast for the period 2018 - 2045. The city does not have a coherent strategy [1].

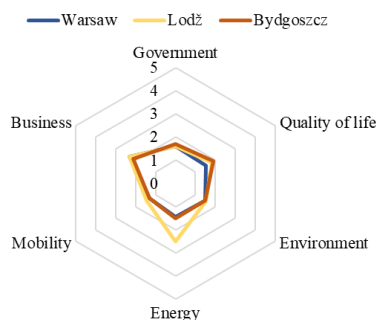


Figure 3: Benchmarking – Warsaw, Łódź, Bydgoszcz
Source: own processing according to [1]

The comparison in Figure 3 revealed a uniform point position with the city of Bydgoszcz (lack of strategy and coordinator for the Smart City area). Areas of government, business, environment, mobility and quality of life were evaluated homogeneously (with minimal deviations of the three analyzed sites).

The best practice according to the results of the network graph is Łódź [1]. The city of Łódź does not have a strategy in the area of Smart City development and sustainability, there is also no coordinator, the projects are implemented mainly in the field of energy, for which it is the best practice for other Polish cities. The Action Plan is set for the Regional Development and Reconstruction Program 2026+ [1].

3.4 Slovakia

Slovak regions are increasingly interested in participating in Smart City projects. Interesting investment areas for Slovak entrepreneurs are especially areas of limited resources, mobility and parking. The benefits of the implementation of IoT technology are especially valuable data sources and their use to support management and decision-making. Research in the Slovak Republic has shown to the following problems [8]:

- absence of a coordinator for Smart City issues,
- small financial support,
- missing mechanism and management model for the concept of developed cities and municipalities.

The East Slovak Investment Agency is launching a platform for the Smart Region of Eastern Slovakia, whose mission is to build a network of Smart Cities in the east of the country. Nitra (mobility area) became the first "Smart City". The application of the strategy for the cities of Prešov, Poprad, Trenčín and Bratislava is currently being prepared (approx. 2020 - 2030). Antik also created a platform for "intelligent" Slovak regions. The network receives data from IoT sensors and transmits it to a PC, TV or smartphone via an IoT gateway [10].

The Finnish Oulu is a reference point for Slovak cities that want to become a "smart" place to live and work. The strategy works on a bottom-up basis, using elements of project management for the three key pillars of

development, i. e. data (platforms), citizens and innovation (digitization). The views of all stakeholders enter into the management and decision-making processes of the city management. Cooperation with small and medium-sized enterprises is a critical element of success. Within the support of Slovak cities, various events, conferences and organizations are created, such as Smart Cities Club and Smart Cities Cluster [13].

The capital of the Slovak Republic, Bratislava, does not have any Smart City development strategy. The individual planned projects are set for three stages. The first stage (2018-2020) contains a security proposal and the identification of key activities. The second stage (2021-2025) will focus on the preparation of new activities and evaluation of the fulfillment of objectives, the last section (2026-2030) will evaluate the objectives set for 2030 with the adoption of corrective measures. Implementation will include plan control, mutual communication, crowdsourcing, site management and the promotion of change and innovative activities [2].

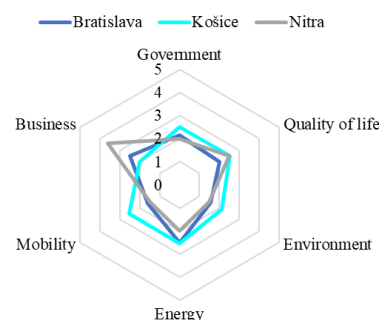


Figure 4: Benchmarking – Bratislava, Košice, Nitra
Source: own processing according to [1]

Due to the lack of a coordinator, competences in this area have been assigned to the head of the innovation department, who, however, only has to answer questions about Smart City [1]. The highest point rating (from 0 to 5 points) was obtained by Bratislava (Figure 4) in the energy section. The opportunity for improvement is primarily the area of the environment. The best practice for Slovak cities is represented by Košice, which gained the most points out of the six examined elements in up to three of them (compared to two other surveyed cities). Košice does not have a Smart City strategy and is developing mainly in the field of energy and mobility, including the environment. Smart projects are managed by a vice-mayor [1]. Nitra is the only Smart City in Slovakia that has a strategy, which can be found in the following documents [1]:

- Sustainable Mobility Plan,
- Energy strategy of Nitra,
- Energy and greenhouse gas reduction action plan.

The primary authority responsible for building Smart City concepts is the mayor's office. Nitra received the highest points in the part of business (support for small and medium-sized enterprises as an important stakeholder in

Smart City) and quality of life. The focus on the environment is an opportunity for improvement [1].

3.5 Cities and Reputation Management

Smart Cities reputation management is directly linked to the level of external and internal communication between citizens, local councils, businesses and the government. The level of reputation should be supported through relevant information, which is mediated by the services of the so-called e-Government through integrated online communication platforms [4]. Figures 1 - 4 show that the highest points in the area of government quality, and the resulting quality of reputation, in the Czech Republic are Prague, in Poland and Hungary cities have a balanced rating in the area, in Slovakia they achieved the highest rating in Košice. In general, the level of reputation in these V4 cities is low compared to the world.

4. Discussion

From the comparison of the best practice of Smart Cities in the Visegrad Four countries, the common and different elements of building smart city concepts were summarized in Table 1. A critical element of success in creating Smart City concepts is the coordinating component that facilitates smart project planning and implementation processes. Cities should have a generated and accessible Smart City strategy, the transparent publication of which has a positive effect on stakeholder participation. The best practice in benchmarking in the part of the environment was gained by Brno, Budapest, in Poland all three surveyed cities had the same value in the environment and in Slovakia it was Košice. Only Polish and Hungarian cities have achieved a high level of awareness of Smart City concepts.

Table 1 Common and different elements of Smart Cities in V4 countries

Location/ Elements	Environment	Participation	Awareness	Strategy
Czech republic				
Prague	No			Yes
Brno	Yes	high	not enough	Yes
Ostrava	No			Yes
Hungary				
Budapest	Yes	high	key	Yes
Debrecen	No			Yes
Poland				
Warszaw	Yes			Yes
Lodź	Yes	high	acceptable	No
Bydgoszcz	Yes			No
Slovakia				
Bratislava	No			No
Košice	Yes	moderate	not enough	No
Nitra	No			Yes

Source: own processing according to case studies in section 3.

5. Conclusions

The development of smart city concepts depends to a large extent on cultural and historical aspects. Hungary and Poland are among the countries that are positively oriented

towards change, innovation, reputation and development. In the Czech Republic, a low level of awareness of the researched issues prevails and traditional Slovakia is only beginning to focus on the implementation of Smart Cities concepts on a wider scale.

Most of the researched cities are specific in the area of smart mobility. Concepts in Slovakia are supported by the emergence of cooperative groups, e.g. Smart City Clustrom. The model for Slovakia are Finnish cities and their reference models, which, however, do not reflect cultural and our local conditions. For this reason, it would be appropriate for Slovak cities to be modernized on the basis of the best practices of the V4 countries.

Acknowledgements

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SPECIFICS AND PROBLEMS OF MAKING METHODOLOGIES OF INNOVATION CAPACITY EVALUATION AND VITALITY SMEs IN INDUSTRY

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Abstract: *The contribution from the methodology for the evaluation of innovative potential and factors for small and medium industrial enterprises is part of the longer-term extensive research and educational activities of the author. Explains the main concepts in innovation, the current situation in the field and indication of the internal innovation network and its parameters in SMEs, represents its own scheme for the selection of appropriate analyses and the diagnostics of the undertaking and is the recommended outputs and the production and quality of production and the related management tool for a comprehensive approach manual Innovative production management.*

Keywords: *Innovations, innovation capacity, innovation vitality, SMEs, organizational module*

1. Introduction

Over the last decade, the scientific approach to innovation has changed dramatically. Innovation no longer means only intentional, new and beneficial change exclusively in the organizational and team context, and the definition of change or the creation of a new process or product, as defined by several major world authors such as Grossman and King, Roffe, Peters and Waterman, Pietrasinski, Drucker et al., cited clearly in the source [1], but innovation also covers organizational change to achieve a new approach, flexibility and adaptability, especially for SMEs in world markets and the progressiveness of their capabilities in the future with high production efficiency, permanent satisfaction of the needs and expectations of current and future customers and a sustainable social, energy and ecological environment. [8, 9, 11], Today, managers learn how to understand innovation not only as a management tool, but primarily as a process that can be managed, changed and influenced effectively for the success of SMEs, so that it is a literal organic type capable of adapting to unstable and changing conditions and factors, and progressively able to constantly overcome problems. It is about managing the company based on demand and mapping the needs and expectations of customers. [2]

Innovation – literally translated from Latin means "renewal". [15] Today, there are more than 200 different definitions of innovation, the common feature of which is the [3, 7] application of a new idea, change/improvement, new idea, invention. The European Commission (2004 - Green Paper on Innovation) understands innovation as synonymous to the successful production of assimilation and the use of innovation in the economic and social spheres to meet the needs of society and individuals. [6] Then we understand Innovation - renewal, introduction of new knowledge and solutions into the existing system and thus achieve higher value, improvement, and a new condition. General theories today know seven lines of innovation. [4, 5] The founder of innovation theory, J. A.

Shumpeter, quoted: "Innovation is the practical transfer of ideas into new products, processes, systems and social relationships." [3] Innovation is an intuitive, creative and finally consistent activity, and includes technical, design, production, management and business, organizational and social activities related to the launch of a new improved product or process. A lesson is known: "Innovation is a process (not an action, event, or phenomenon) and as such must be managed. The factors that determine this process can be influenced and thus influence the result". [13]

The innovative capacity of the company is given by competitive advantages in the field of quality, efficiency and flexibility. The company itself as a producer and at the same time a successful innovator has the ability to explore the unknown and can continuously, quickly and easily operate in the market through innovations at a price advantage from competitors. [7, 9] The innovative vitality of a company is its ability to prove the state when it exists today without its present existence limiting its future existence beyond what is necessary. It is therefore a system of functioning that strives to be a sustainable success. [16] In my opinion the innovative vitality factor corresponds to the ability of a company to find out in practice how long it will last in the catchment market of business and product operations, while the very existence in real time and environment wears and consumes it, and whether its results are permanent or temporary, successful or unsuccessful, literally futile and unnecessary, or efficiently and ecologically clean, beneficial or dangerous, that is a question of whether a company exists in accordance with the environment of its existence or in conflict with it. [14]

Innovation synergy and innovation vitality create in their synergy the respective innovation potential, which speaks about the ability of the company to use its innovation assets to increase competitiveness [16] and manifests itself in a specific space - the innovation dimension, consisting of the evaluation dimension (status - good, pleasant,

successful or bad, inappropriate, etc.), then from the dimension of strength (energy charge of the term - dominant, strong, weak, indistinct, etc.), and finally from the dimension of activity (its expression - dynamic, or calm and passive, etc. [15] In professional practice in the conditions of SMEs, it is essential for the creation of the methodology to know the decisive specifics and types of value innovations in process management, namely:

1. Value analysis (improvement of existing objects),
2. Value design (creation of new objects, processes and products),
3. Inverse value analysis (better use of existing objects, processes and products),
4. Value product strategy, forecasting the production, business focus of the company. [11]

2. Indication and formulation of the innovation network and its parameterization

Every output created for the market in the company is actually a temporary effort made to create and implement an unique engineering - technical product, project or service with a defined result, exclusively for the customer. Then (result/output) of the project/product is the goal, result, or other material determinant to be created by such an implementation.

New professional requirements for management and staff in SMEs and growing expectations mean that companies and organizations have to consider changing the conventional way of thinking and move to more effective ways of management.

However, unless the necessity of the change is determined, it is not possible to determine the purpose and method of making the change. According to these principles, one of the most effective changes seems to be the fundamental management of business processes.

The transition to new management methods is also made possible by new innovative approaches and new information technologies, which are part of the management information system of companies. [5]

The essence of the developed methodology for verifying the ability to innovate and assess the state and level of innovation capacity and vitality in the conditions of the company is the applied creation of an innovative network of complexity conditions, which (according to the often quoted founder of modern application theory of innovation in Slovakia - Mr. František Valent) is shown as a table 1: conditions of complexity [4, 9, 11] for designing an internal corporate innovation network.

In this table (which in practice is basically based on the data obtained from the SWOT analysis of the company) and its own subjective observation are marked the so-called stimulating and so-called induced innovations in individual components of the company (factors) and corresponding levels of management.

Table 1 Designing an internal innovation network of an SME company [4, 9, 11, author]

Factor, Management level	P	S	VZ	PS	T	O	Q	E
A	O	O	X	O	O	O	X	O
B	O	O	O	O	X	O	O	O

where:

A: management level

VZ: process/production procedures

B: managed level - executive team

O: organization of the internal structure

x: stimulating innovation - stimulates change

E: energy, creativity in others

o: induced innovation factors

P: production/service

Q: quality and evaluation

S: inputs/supplies

T: technological system

PS: workers

Evaluation: The above proposal of the innovation network created by synergy from the conclusions of individual analysis in the author's research work [6, 7, 8] shows that at the top management level the company must significantly expand stimulating innovations to parts P, S and O and the second level - executive workers, it is necessary to ensure innovations in P, VZ, Q and E in order to achieve the effect of increasing innovation.

3. Concept and methodology of individual selected analyzes and diagnostics

For objective and responsible examination of the state and level of management processes, organizational structure and functioning of internal links in a given business entity or organization, there are specific methods developed in theory and assessment of the state and such methods of strategic analysis, methods of diagnosis and measurement of parameters and other decision support tools for SME type management. [7, 8, 11]

In order to design procedures and implement the results of proposed and prepared analyzes and diagnostics of the surveyed SME in the creation of a new Innovation and Quality Program, it is always necessary to perform an audit of innovation management as a specific method of strategic analysis in the analytical part of methodology creation and evaluation.

Audit can be seen as a mechanism to facilitate the creation of a company evaluation structure and its strategy linked to innovation.

These are processes associated with production and project activities, organizational structure, its internal management culture, sales technology, project management and servicing of services and consulting at the customer and the acquisition of knowledge and management dynamics. It is necessary to determine according to the available

knowledge [10] a set of factors that currently significantly affect the success or failure of innovation in the company and the accepted scale of evaluation, thus creating a profile of current innovation performance, which results in formulating the principles of new innovative approach as a crucial element for strategic management and planning in the program. As the selected applied analytical methods were briefly indicated in the introduction of this paper within the chosen overall methodology for data processing and creation of process control proposals, so for clarity of the chosen work procedure in the following figures 1 and 2 [author] can be summarized in the flow chart and diagnostic activities, and this is followed by the scheme of the concept of the methodology of comprehensive assessment of companies from the SME portfolio.

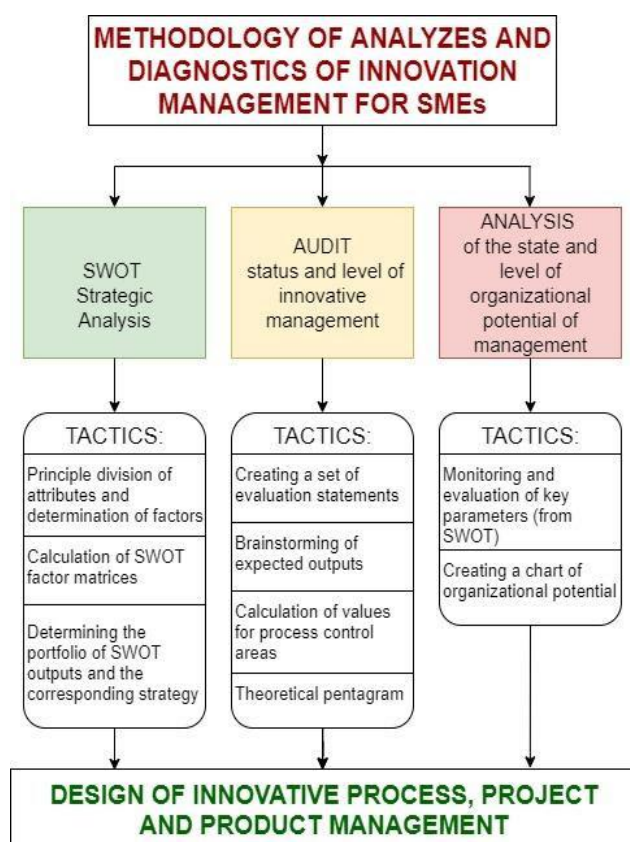


Figure 1 Scheme of proposed selection of analytical and diagnostic methods of evaluation and creation of methodology

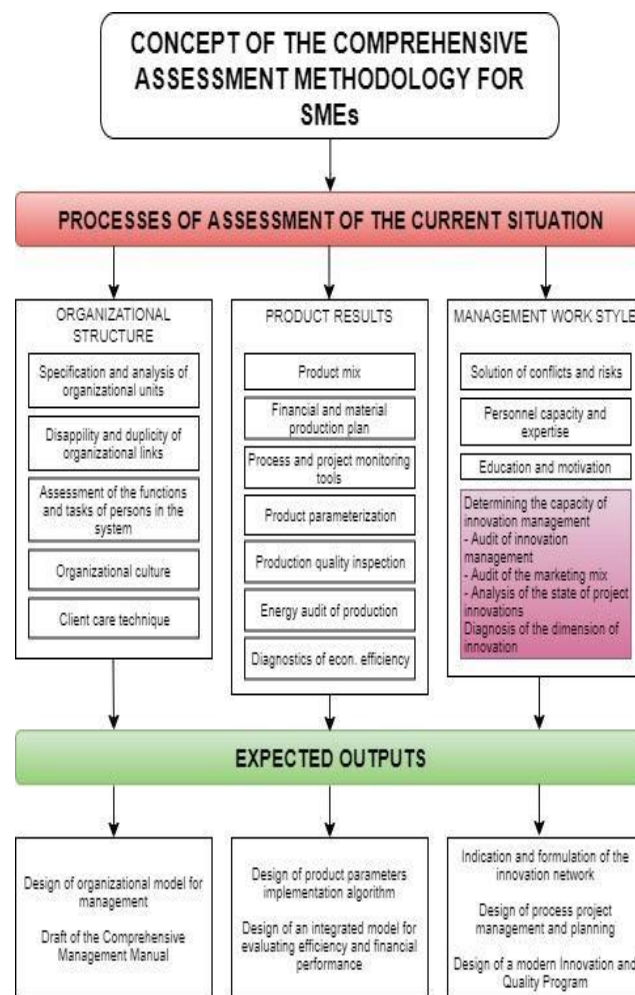


Figure 2: Scheme of planned activities and tools for assessing the innovation capacity and vitality

From the picture it is necessary for the needs of the solution of analyses and diagnostics in the topic of the dissertation to pay attention to the block marked in dark red, which specifically concerns audits, analyses and diagnostics of the state and level of researched SMEs, their management and organizational system and production and project activities in business activities. Management tools developed on the basis of the proposed concept, as assumed by its principles themselves, will not be specialized in individual functional areas. They will focus on diagnosing problems of various natures, their causes and nature, regardless of whether it is a problem of "marketing, human resources, production, financial resources" and the like. The advantage of the concept is a large degree of openness, which allows tools to build modularly - to extend the architecture with new layers of models, to supplement them with new content processing mechanisms, universal or specialized libraries.

4. Recommended outputs of the evaluation of innovation capacity and vitality of SMEs

It is based on figure 2 describing planned activities and tools for assessing innovation capacity and vitality of SMEs.

Table 2 Substantial outputs from SME management evaluation

Innovation and production quality program	<p>A serious thing for the project management of an SME company is the process from the initial idea of innovation to a successful applicable product or service. It is basically a kind of "innovation funnel", i.e. the process of managing the reduction of uncertainty of an invented new thing through a series of solutions to problems and obstacles where the company moves from the idea, concept and scanning phase of development to selection and implementation, constantly changing environment and where new diverse information is emerging. The starting point and basic database of information in the development of a modern organizational module is the state, which was based on a well-known, long-term inertial static state, where all major activities are performed by organizational units without interconnection, dynamics and ability to resolve risks and conflicts.</p>
A manual of a comprehensive approach for innovative management of SME production	<p>An enterprise in the SME category is recommended to introduce a basic Manual of a comprehensive approach, i.e. a procedure for solving problems in production management and project implementation [5, 13] with a proposal of required inputs and expected outputs in innovation [8, 11], and defining specific processes and activities:</p> <ul style="list-style-type: none"> -Initialization and start of creating products and processes in the company -Planning of production realization activities -Implementation of own internal rules of creativity and innovation -Management and coordination of the company's production -Monitoring and correction of compliance with the quality parameters of the company's production -Occupancy and knowledge of professional background of staff and management -Developing the abilities and skills of an executive production team -Specification of needs, expectations and selection of subcontractors of inputs to production -Information and evaluation internal database -Location and economic effect of production on the relevant market.

Many analysts agree in their quotes that "if a company wants to be successful and show a high degree of innovation, it simply has to try more things and more activities and more products and projects." Unlike common management practice, where the problem is

solved according to existing experience, habits and common schemes (comparison with routine and recurring situations), the proposed procedure is a demanding process, which requires time and certain costs, as well as creativity and discipline in fulfilling individual steps, but it brings a significantly different quality level of management decisions through multi-stage decision-making and correction of findings - an innovative approach. A serious thing for the project management of an SME company is the process from the initial idea of innovation to a successful applicable product or service. It is basically a kind of "innovation funnel", i.e. the process of managing the reduction of uncertainty of an invented new thing through a series of solutions to problems and obstacles where the company moves from the idea, concept and scanning phase of development to selection and implementation, constantly changing environment and new diverse information is emerging.

6. Conclusions

Today, the market is developing at a sophisticated, generalizing, global and especially dizzying pace. This development also brings with it an increase in the complexity of problems and the identification of new effects of the functioning of systems, in which managers and project teams of companies from the SME portfolio are increasingly difficult to find their way around. However, in the fight against this complexity, various management tools come to their aid. A look at any known methodology or management tool, even if the most sophisticated model of the organization is analyzed, is still accompanied by perceptions and feelings, as if it was missing something. The knowledge and design contained in this paper give the existing visions and ideas not only a philosophical framework, but also materialize it into a specific project-oriented, set design concept of a new generation of organizational systems modelling whose key mission is to create a modular environment for the Innovation and Quality Management Program in terms of concrete Implementation with companies for innovative management and subsequently a comprehensive approach manual for innovative production and project management in SMEs. This is all the more important as the interconnection of SMEs into clusters, the synergy of economic, operational, technological and technical factors and their effective and especially simple monitoring can be a link for the survival and competitiveness of SMEs in the future. This paper builds its thoughts and results in direct connection with business management practice in the implementation of the research grant project NFP313020ANX5, with the support of the Ministry of Economy and ESI Funds under the title: "Design and development of integrated innovation infrastructure and knowledge base in Europe"

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VALUE CREATION INDICATORS IN BUILDING RELATIONSHIPS WITH SUPPLIERS IN SLOVAKIA AND OTHER COUNTRIES

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Abstract: *The relationship between the enterprise and its stakeholders, such as suppliers, becomes more and more important nowadays. The reason is that these mutual long-lasting, sustainable relationships lead to the growth of both sides (enterprise and the supplier), secure the enterprise's competitiveness, and achieve the suppliers' loyalty and trust. The paper's content is to bring a closer look at the issue of value creation indicators with a focus on the suppliers as the major enterprise's stakeholders. The paper aims to identify the indicators which enterprises provide to their suppliers the most. That means what indicators the enterprises are focusing on when providing value to their suppliers and the differences in providing the value creation indicators in the case of enterprises from Slovakia and abroad. The objective of the research is to create a list of the most provided indicators. The research was conducted through questionnaires. The paper describes the provision of the value creation indicators in the case of 149 enterprises (108 from Slovakia and 41 from other countries).*

Keywords: *provision of value indicators, value creation indicators, value, stakeholders, suppliers*

1. Introduction

Enterprises as buyers (customers) have mostly benefits and costs in their minds [8], which meaning can be monetary or non-monetary [1]. Under monetary terms, the enterprise understands revenues and costs. Furthermore, under the non-monetary terms, trust, reputation, decreased time, effort, energy-saving, and suppliers' loyalty can be understood. If the enterprise wants to grow its relationship with its suppliers, it needs to work on it. This way, the enterprise can achieve loyalty, the trust of the suppliers and increase its competitiveness. This all leads to securing long-term cooperation and mutual tolerance. The way how the enterprise can reach these goals is through the value creation process. To provide the suppliers exactly with the value that fulfils their needs, the enterprise must know suppliers' requirements, approaches, and attitudes. This way, the enterprise would not waste its time, capacity and financial resources.

The paper focuses on preparing the list of most provided value creation indicators to the suppliers by enterprises. The research is based on enterprises operating on the Slovak market as well as abroad. Thanks to this, it is possible to bring a closer look at the provision of suppliers' value worldwide, not only in the domestic market.

The theoretical basis of the research is the international standards EN 1325:2014 Value Management – Glossary – Terms and Definitions and EN 12973:2020 Value Management. These standards define value as the degree to which a product, project or enterprise satisfies the needs of stakeholders in relation to the resources consumed [2][3].

These standards further describe the indicator as a specific attribute, where each of its changes affects the value of the assessed entity. The first step in creating value for supplies is identifying value and its indicators with subsequent consideration of their perception. Indicators provide

information or a picture that something exists or is true [5]. The indicators' fundamental importance is that they allow comparisons in different geographical areas or over time [5]. Indicators can be both quantitative or qualitative.

Value co-creation is an interactive business relationship among various stakeholders of the enterprise. These stakeholders create business and provide values with the same goal [6]. This can be seen in the relationship between the enterprise and its supplier. However, many supplier-buyer relationships are highly power-asymmetric. The reasons are different goals, resources, expectations, knowledge [7] [4]. Therefore, if an enterprise wants to provide the value creation indicators to the suppliers, it has to know their needs, goals, objectives, and attitudes first.

2. Methodology

The paper aims to identify the indicators which enterprises provide to their suppliers the most. The research within the article is carried out through structured questionnaires. The paper's other research methods are logical methods, including induction, deduction, analysis, synthesis.

The paper's research problem focuses on the provision of value creation indicators. The paper summarizes the most provided indicators to the suppliers.

The main research questions are as follows:

1. Which value creation indicators are provided to the suppliers the most?
2. Is there a difference in the provision of the value creation indicators between Slovakia and other countries?

The research was carried out through questionnaires sent to the managers of enterprises providing services and manufacturing enterprises. These enterprises operate in

Slovakia and worldwide. One hundred forty-nine responses were collected, 108 from Slovakia and 41 from other countries.

The foreign enterprises participating in the research are from Europe, North, Latin and South America, Australia and Asia. The breakdown is as follows:

Table 1 Countries participated in the survey and number of respondents

	Countries	Number of respondents
Europe	Belgium, France, Germany, Ireland, Lithuania, Spain, Switzerland, United Kingdom	17
North America	Canada, USA	14
Latin and South America	Mexico, Ecuador, Colombia, Guatemala	5
Asia	Nepal, Korea, Japan	3
Total (other countries)		41
Europe	Slovakia	108
Number of respondents in total		149

The questionnaire questions concerned the value creation indicators which an enterprise as a value provider provides to its suppliers. Within the article, individual answers are evaluated for all respondents, separately for respondents from Slovakia and separately for respondents from other countries. The main reason is to point out the difference in the provision of value creation indicators.

The respondents were asked to express what indicators do they provide to their suppliers. They were provided with the following list of indicators:

Table 2 List of value creation indicators for suppliers

Regularity of orders	Shortening the due date period, one-time payments
Adherence to business conditions	Satisfaction surveys
Payment of invoices (liabilities) within due date	Feedback demand
Friendly relationships, team buildings	Joint problem solving
Business meetings	Identifying suggestions and questions
Providing feedback (reviews)	Reward system in compliance with business conditions
Recommendation of the enterprise (goods/services) to other buyers	Providing information on the solvency of the enterprise
Business promotion assistance (goods/services)	Relationships beyond contractual conditions, willingness to communicate in solving problems
Increasing the frequency of orders, increasing the quantity of ordered goods/services	Providing comments on improvements, questions and recommendations
Regular enterprise bulletins related to news in production, transport, etc.	Reassessment of contractual conditions, procedures, changes based on mutual communication
Regular (monthly, quarterly, semi-annual, annual) meetings	

3. Results of the research

Creating value for suppliers is important when creating good long-term business relationships, increasing competitive advantage, and securing a market position. Enterprises (149 respondents from Slovakia and other countries) answered which indicators of value creation do they provide to their suppliers, i.e. on which enterprises focus the most when securing good long-term sustainable relationships with their suppliers. The research results also provided information not only regarding the indicators which enterprises provided the most to the suppliers but also which indicators are not provided by those enterprises or only to a small extent.

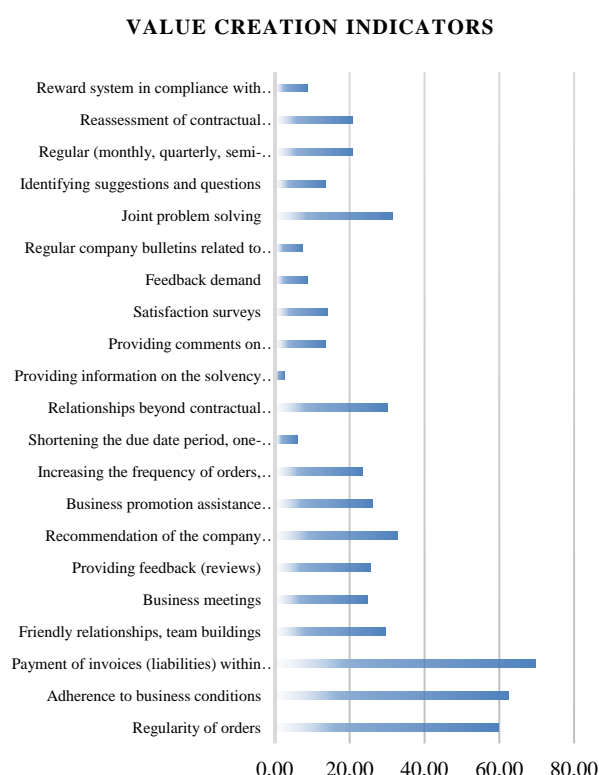


Figure 1: Provision of the value creation indicators to suppliers by the enterprises (in percentage)

Slovak enterprises and enterprises from other countries answered questions concerning the actual provision of value to their suppliers and the indicators they provide the most (see fig. 1). Indicator "Payment of invoices (liabilities) within due date" is provided to the suppliers by 69,80% of enterprises. "Adherence to business conditions" is provided by 62,42% of the enterprises and "Regularity of orders" by 59,73%. On the contrary, the least provided indicators of value creation include, for example, "Providing information on the solvency of the company", where only 2,68% of respondents answered that they provide the given value to its suppliers. Other indicators of value creation, which are provided to the suppliers to a very low extent, are also

- Shortening the due date period, one-time payments (6,04%).
- Regular enterprise bulletins related to news in production, transport, etc. (7,38%).
- Feedback demand (8,72%).
- Reward system in compliance with business conditions (8,72%).

The difference in providing value creation indicators is between the enterprises from Slovakia and other countries. They are influenced by diverse geographical, political situations, stability of the country, resources, taxes, and the nature of the people, their needs, opinions, and requirements. These elements influence the enterprises and the indicators they provide to their suppliers.

VALUE CREATION INDICATORS

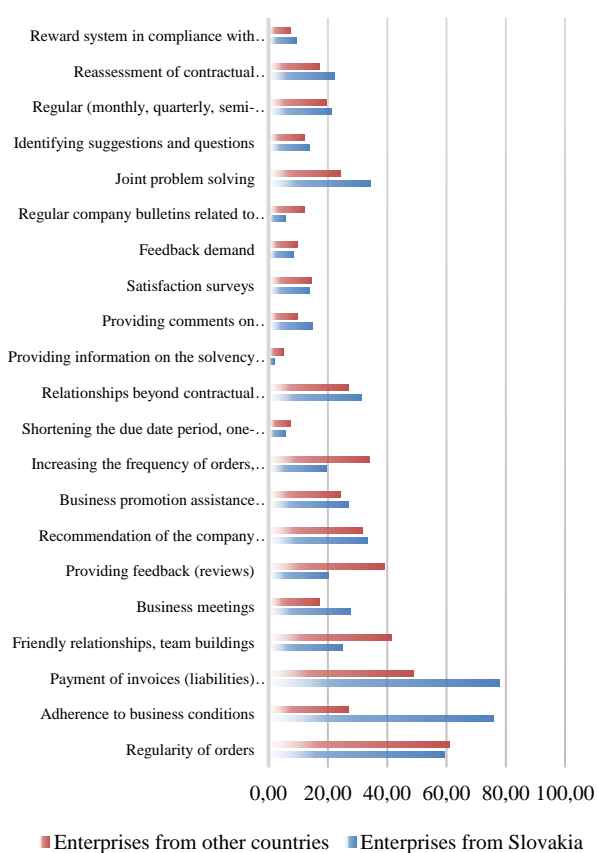


Figure 2: Provision of the value creation indicators to suppliers by the enterprises from Slovakia and other countries (in percentage)

Figure no. 2 points out the differences in providing the value creation indicators in Slovakia and other countries. Respondents (108 enterprises from Slovakia and 41 from other countries) identified the indicators they provide to their suppliers. As seen in figure no. 2, enterprises provide some indicators to their suppliers both in Slovakia and abroad, but there is a vast difference in some cases. For example, based on the data obtained from the respondents,

it is clear that enterprises from Slovakia provide their suppliers with the stability of their business relationship. As they pay their liabilities within the due date, what was indicated by 77,78% of respondents from Slovakia compare to 48,78% of respondents from other countries. The second huge difference is in the case of "Adherence to business conditions". This indicator is provided to the suppliers by 75,93% of enterprises from Slovakia, but just 26,83% of enterprises from other countries. Also, "Joint problem solving" is, in general, not provided to the suppliers much. However, the difference between the provision by the enterprises from Slovakia and the enterprises from other countries is big as 34,26% of respondents indicated that they provide their suppliers with the given indicator compared to 24,39% of respondents from other countries.

On the other hand, the indicators such as "Increasing the frequency of orders, increasing the quantity of ordered goods/services", "Providing feedback (reviews)" and "Friendly relationships, team buildings" are provided to a greater extent to the suppliers by enterprises from other countries than by enterprises from Slovakia. "Increasing the frequency of orders and increasing the quantity of ordered goods/services" is provided to the suppliers more by enterprises from other countries, as indicated by 34,15% of respondents from abroad compared to 19,44% of respondents from Slovakia. The same is in the case of "Providing feedback (reviews)" provided to the suppliers more by the enterprises from other countries as was indicated by 39,02% of respondents from abroad compared to 20,37% of respondents from Slovakia. A huge difference is also in "Friendly relationships, team buildings", which is provided to the suppliers by 41,46% of enterprises from other countries compared to 25% of respondents from Slovakia.

6. Conclusions

The paper aims to identify the indicators which enterprises provide to their suppliers the most. That means what indicators the enterprises are focusing on when providing value to their suppliers and the differences in providing the value creation indicators in the case of enterprises from Slovakia and abroad. The objective of the research is to create a list of the most provided indicators. Suppliers build relationships with their buyers based on the value which is provided to them by the enterprises. The paper's content is also to bring a closer look at the issue of value creation indicators with a focus on the suppliers as the major enterprise's stakeholders.

Based on the research, it was possible to answer the research questions defined in the methodology section. Answers to research questions:

- 1) Which value creation indicators are provided to the suppliers the most?

Based on data from the research it was possible to create the list of most provided indicators in general and separately in Slovakia and abroad.

In general, the most provided value creation indicators based on the respondents from Slovakia and abroad are as follows:

Table 3 List of the most provided value creation indicators to suppliers in general

No.	Value creation indicator	Percentage
1.	Payment of invoices (liabilities) within due date	69,80%
2.	Adherence to business conditions	62,42%
3.	Regularity of orders	59,73%
4.	Recommendation of the enterprise (goods/services) to other customers (buyers)	32,89%
5.	Joint problem solving	31,54%

The most provided value creation indicators separately in the case of enterprises from Slovakia and from other countries are stated in the following table.

Table 4 List of the most provided value creation indicators to suppliers by the enterprises from Slovakia and abroad

No.	Value creation indicator (Slovakia)	%	Value creation indicator (abroad)	%
1.	Payment of invoices (liabilities) within due date	77,8	Regularity of orders	61,0
2.	Adherence to business conditions	75,9	Payment of invoices (liabilities) within due date	48,8
3.	Regularity of orders	59,3	Friendly relationships, team buildings	41,5
4.	Joint problem solving	34,3	Providing feedback (reviews)	39,0
5.	Recommendation of the enterprise (goods/services) ...	33,3	Increasing the frequency of orders, quantity of orders...	34,2

2) Is there a difference in the provision of the value creation indicators between Slovakia and other countries?

Based on the data from the research, it was possible to determine the differences between the provided indicators in Slovakia and abroad. As shown in figure no. 2, the huge differences could be found in providing value creation indicators in Slovakia and abroad. It shows that enterprises from Slovakia focus more on compliance with business conditions than the enterprises from other countries when providing value to their suppliers. On the other hand, enterprises from other countries focus more on providing feedback and building friendly prelatships with their suppliers than those from Slovakia (see figure no. 2).

The differences are also in the case of the most provided value creation indicators by enterprises from Slovakia and other countries. For example, the indicator "Payment of

invoices (liabilities) within due date" is on the list of TOP 5 most provided indicators in enterprises operating in Slovakia and abroad. However, in the case of enterprises from Slovakia, up to 77,8% of respondents indicated that they provide the indicator to their suppliers compare to 48,8% of respondents from other countries (see table 4). Based on the research, it is obvious (see table 4) that the enterprises from Slovakia provide their suppliers more values or higher extend than enterprises abroad.

The article points out the individual indicators provided to suppliers by Slovak enterprises and enterprises from other countries. The aim is to point out the importance of value creation for the suppliers and individual value creation indicators. This article is a preparation for further research, which should focus on the next step in identifying the perception of value creation indicators for suppliers and their importance.

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THE IMPORTANCE OF VALUE CRATION INDICATORS AND THE RELATIONSHIP WITH SUPPLIERS IN SLOVAKIA AND OTHER COUNTRIES

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Abstract: *The importance of the supplier-buyer relationship grows as both sides want to prosper and secure their existence in the market. Suppliers and buyers need to secure their market position, competitiveness, profitability, and performance. Therefore, they need to find a way how to ensure long-term and sustainable relationships. The way to create a good mutual relationship with its business partners is to pay attention to them, perceive and fulfil their needs and perceive their attitudes and opinions. This way, the enterprises will create value for their business partners, which leads to the achievement of their loyalty and trust. The paper focuses on the relationship between the enterprise and its suppliers. The paper aims to identify the most important value creation indicators when providing value to their suppliers. We assume that if enterprises perceive the importance of value creation indicators, then they provide those indicators to their suppliers. The research objectives are to determine the most important value creation indicators and to evaluate the mutual relationship between enterprises and their suppliers. On the one hand, the paper describes the importance of value creation indicators (from the side of enterprises – buyers) in the case of 149 enterprises (108 from Slovakia and 41 from other countries). On the other hand, it evaluates the relationship between the enterprises and their suppliers (from the side of enterprises – buyers).*

Keywords: *value creation, value creation indicators, suppliers, stakeholders, value creation*

1. Introduction

Nowadays, enterprises working hard on maintaining relationships with their suppliers. The most important reason is to grow, to achieve competitiveness and to secure the business. The reason can also be the decrease of the suppliers, which reduce the availability of other alternatives [1]. Therefore, the suppliers' satisfaction somehow becomes the primary indicator when the suppliers decide who become their first choice supplier [2], as this supplier gets various benefits, such as technology, financial and non-financial benefits [3]. On the other hand, for enterprises to increase their competitiveness, they rely on their suppliers to be in charge of various operations (e.g., delivery, sales) [4]. Usually, business partners tend to maximize their interests, priorities, needs. That can cause problems and disruptions in their relationship [5]. Therefore, enterprises should focus not just on their needs but also pay attention to their suppliers, perceive and fulfil their needs and perceive their attitudes and opinions.

Subsequently, as the enterprise knows the opinions, needs, attitudes of its suppliers, it can start maintaining the relationship with them. The way how the enterprise can achieve it is through creating and providing value to their suppliers. We assume that enterprises would provide their suppliers with the value creation indicators in which to they see the most significant importance. However, this applies if the enterprise has enough resources (financial and non-financial such as time, capacity, people) to do so.

At first, enterprises should evaluate their relationship with suppliers to see if the relationship is satisfying and needs any improvements. If the enterprise is satisfied with the

relationships with suppliers, it should maintain these good relations, not just leave them as they are.

The paper focuses on the determination of the most important value creation indicators provided by the enterprise to its suppliers and on evaluating the relationship from the point of view of the enterprises as the buyers.

It can be said that the relationship between the enterprise and the suppliers is based on the supplier's satisfaction. Supplier's satisfaction is when outcomes from the buyer-supplier relationship exceed or at least meet the supplier's expectations [6]. On the other hand, the supplier can be dissatisfied with the relationship when the supplier's expectations do not meet the buyer's legalization of value [7].

2. Methodology

The paper aims to identify the most important value creation indicators when providing value to their suppliers and to evaluate the mutual relationship between enterprises and their suppliers.

Providing value creation indicators is an important part of building long term sustainable relationships with suppliers. Why do enterprises provide suppliers with the very values they provide? How important are they to them? These questions are part of the research problem the paper focuses on.

Main research questions:

1. Which value creation indicators are the most important for enterprises in building a relationship with suppliers?
2. Is there a difference in the importance of individual indicators provided to suppliers in Slovakia and abroad?
3. How do enterprises evaluate their relationship with their suppliers?
4. Is there a difference in the evaluation of the relationship with suppliers by the enterprises in Slovakia and other countries?

The research was conducted through a questionnaire. The questionnaire was sent to the managers of enterprises providing services and manufacturing enterprises. These enterprises operate in Slovakia and other countries worldwide. One hundred forty-nine enterprises responded and provided answers, of which 108 were from Slovakia and 41 from abroad.

The foreign enterprises which participated in the research were from Europe, North, South and Latin America, Asia and Asia.

Table 1 Countries participated in the survey

	Countries	Number of respondents
<i>Europe</i>	Belgium, France, Germany, Ireland, Lithuania, Spain, Switzerland, United Kingdom	17
<i>North America</i>	Canada, USA	14
<i>Latin and South America</i>	Mexico, Ecuador, Colombia, Guatemala	5
<i>Asia</i>	Nepal, Korea, Japan	3
<i>Total (other countries)</i>		41
<i>Europe</i>	Slovakia	108
<i>Number of respondents in total</i>		149

All answers are evaluated for all respondents, separately for respondents from Slovakia and separately for respondents from other countries. The main reason is to show the difference in the assignment of importance to the individual value creation indicators.

The respondents were asked to express what importance do have the indicators for them when providing value to suppliers. They were provided with the following list of indicators:

Table 2 List of value creation indicators for suppliers

Regularity of orders	Shortening the due date period, one-time payments
Adherence to business conditions	Satisfaction surveys
Payment of invoices (liabilities) within due date	Feedback demand
Friendly relationships, team buildings	Joint problem solving
Business meetings	Identifying suggestions and questions
Providing feedback (reviews)	Reward system in compliance with business conditions

Recommendation of the enterprise (goods/services) to other buyers	Providing information on the solvency of the enterprise
Business promotion assistance (goods/services)	Relationships beyond contractual conditions, willingness to communicate in solving problems
Increasing the frequency of orders, increasing the quantity of ordered goods/services	Providing comments on improvements, questions and recommendations
Regular enterprise bulletins related to news in production, transport, etc.	Reassessment of contractual conditions, procedures, changes based on mutual communication
Regular (monthly, quarterly, semi-annual, annual) meetings	

The respondents expressed the importance of indicators mentioned above on a scale from 1 to 5 (1 – no importance, 2 – more unimportant than important, 3 – neutral, 4 – more important than unimportant, 5 – important). The respondents were also asked to express the mutual relationship with suppliers on a scale 1 to 5 (1 – completely unsatisfied, 2 – more unsatisfied than satisfied, 3 – neutral, 4 – more satisfied than unsatisfied, 5 – completely satisfied).

3. Results

3.1 Importance of provided value creation indicators

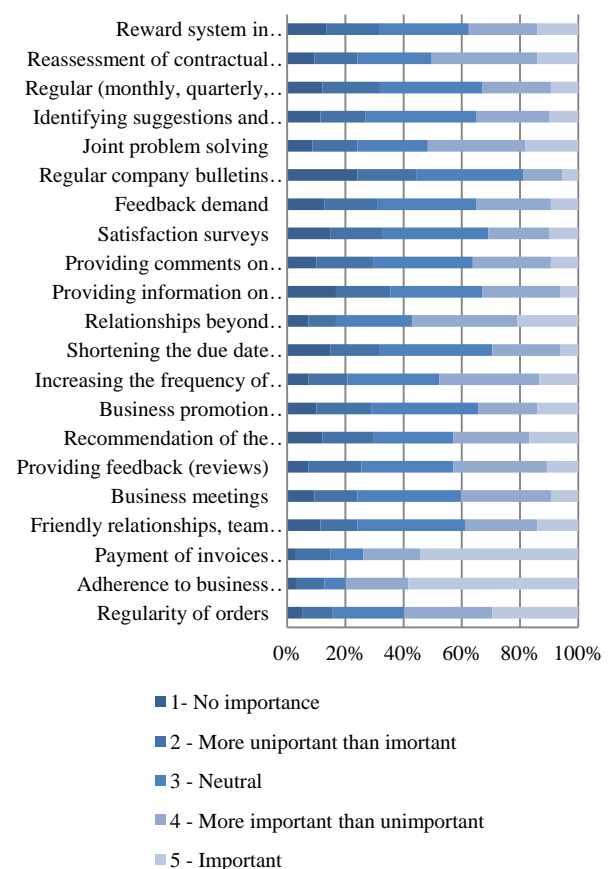


Figure 1: Importance of individual value creation indicators (in percentage)

Enterprises (149 respondents from Slovakia and other countries) expressed the importance of the value creation indicators when providing value to their suppliers. The assumption is that enterprises should provide their suppliers with indicators to which do they assign the highest importance. Subsequently, providing the values to suppliers should improve the mutual relationship and build trust between the enterprise and the suppliers.

The respondents expressed the importance of the given indicators stated in table 2 (see fig. 1). As providers of value, enterprises see great importance in "Adherence to business conditions", where up to 79,87% of all respondents answered that this indicator is important or more important than unimportant. The second most important indicator is based on their answers "Payment of invoices (liabilities) within due date" (73,83%). On the contrary, the least important value creation indicator is "Regular company bulletins..". Up to 81,21% of all respondents assigned neutral importance or indicated that the indicator is unimportant or more unimportant than important. The second least important value creation indicator is "Shortening the due date period, one-time payments" from the enterprise's perspective. In this case, 70,47% of respondents answered that this indicator is neutral, unimportant or more unimportant than important.

The results show the importance of the indicators assigned to suppliers by enterprises in Slovakia and abroad (see fig. 2).

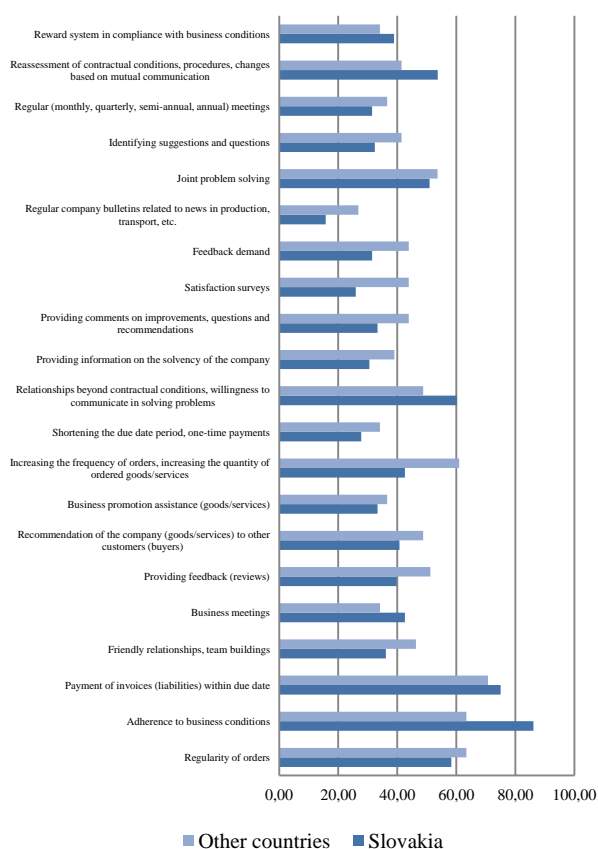


Figure 2: Importance of individual value creation indicators in Slovakia and abroad (in percentage)

Figure 2 shows the percentage of the enterprises from Slovakia and other countries and the value creation indicators in which these enterprises see great importance, i.e. which are important or more important than unimportant.

Enterprises in Slovakia in the position of buyers (as providers of values) see great importance in "Adherence to business conditions", where up to 86,11% of respondents from Slovakia answered that this indicator is important or more important than unimportant. Other important indicators are: "Payment of invoices within due date" (75%), Relationships beyond contractual conditions" (60,19%) and "Regularity of orders" (58,33%). In the case of the other countries, the most important indicators are slightly different. The most important indicator for enterprises from other countries is "Payment of invoices (liabilities) within the due date". Up to 75% of respondents indicated that this indicator is important or more important than unimportant. Other important indicators for the enterprises from other countries are "Adherence to business conditions" (63,41%), "Regularity of orders" (63,41%) and "Increasing the frequency of orders..." (60,98%). The vast difference is in the "Satisfaction Survey", which is important or more important than unimportant for just 25,93% of enterprises from Slovakia compared to 43,90% of enterprises from other countries.

3.2 Satisfaction with the mutual relationship with suppliers

The respondents also expressed how satisfied are they with the relationship with their suppliers.

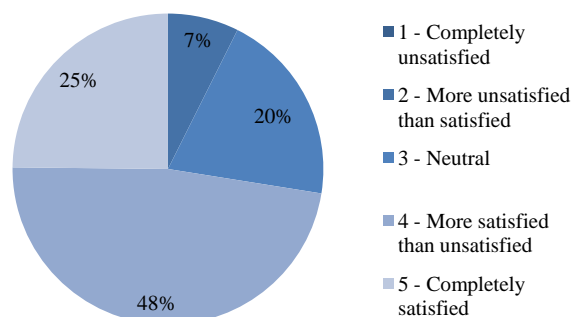


Figure 3: Satisfaction with the mutual relationship with the suppliers expressed by the respondents (in percentage)

In general, as seen in Figure no. 3, the enterprises are completely satisfied or more satisfied than unsatisfied with the mutual relationship with the suppliers, which expressed 72,48% of all respondents. Neutral relationships with suppliers have 20,13% of all respondents, and just 7% are more unsatisfied than satisfied.

When comparing satisfaction with the suppliers in the case of Slovak enterprises and enterprises from other countries (see fig. 4), most enterprises in both cases are either completely satisfied or more satisfied than unsatisfied with the suppliers. This was indicated by 74,07% of enterprises

from Slovakia and 68,29% of enterprises from other countries. Comparable data are in the case of a neutral relationship with suppliers, which was indicated by 20,37% of enterprises from Slovakia and 19,51% of enterprises from other countries. The vast difference is in the case of enterprises that are more unsatisfied than satisfied with the mutual relationship with suppliers. 5,56% of enterprises from Slovakia indicated that they are more unsatisfied than satisfied with the relationship compared to 12,20% of respondents from abroad.

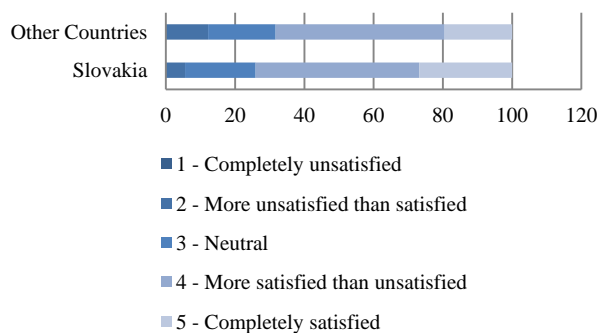


Figure 4: Satisfaction with the mutual relationship with the suppliers expressed by the respondents from Slovakia and abroad (in percentage)

4. Conclusions

The paper aims to identify the most important value creation indicators when providing value to their suppliers. The research objectives are to determine the most important value creation indicators and to evaluate the mutual relationship between enterprises and their suppliers.

Based on the research, it was possible to answer the research questions defined in the methodology section. Answers to research questions:

Which value creation indicators are the most important for enterprises in building a relationship with suppliers? Based on the data from the research, it was possible to create the list of the most important indicators in general and separately in Slovakia and abroad. The most important value creation indicators are as follows:

- Adherence to business conditions (79,87%)
- Payment of invoices (liabilities) within due date (73,83%)
- Regularity of orders (59,73%)

1. Is there a difference in the importance of individual indicators provided to suppliers in Slovakia and abroad?

Based on the research, it is possible to see the differences in the importance of value creation indicators in the case of enterprises from Slovakia and abroad (see fig. 2). The biggest differences are in the case of “Adherence to

business conditions” which is important or more important than unimportant for 86,11% of Slovak enterprises and 63,41 % of enterprises from other countries. The second one is “Increasing the frequency of orders..” which is important or more important than unimportant for 60,98% of enterprises from other countries and 42,59% of Slovak enterprises.

2. How do enterprises evaluate their relationship with their suppliers?

Based on the research (see fig. 3), most enterprises are completely satisfied or more satisfied than unsatisfied with the mutual relationship with suppliers. However, 7,38% of respondents indicated that they are more unsatisfied than satisfied. These enterprises should find the reason and what they can do to improve this relationship.

3. Is there a difference in the evaluation of the relationship with suppliers by the enterprises in Slovakia and other countries?

The difference is in the case of enterprises that are unsatisfied with the mutual relationship with suppliers. Up to 12,20% of enterprises from other countries (compare to 5,56% from Slovakia) are more unsatisfied than satisfied with the given relationship. These enterprises should follow the value creation process to improve the relationship.

This article is a preparation for further research, which should focus on comparing the importance of given indicators from the buyers’ and suppliers’ points of view.

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ENVIRONMENTAL MANAGEMENT IN ORGANIZATIONS

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Abstract: *The concept of environmental protection has become part of the discussions across the society in recent years. Because organizations are an attribute that is largely influenced to our neighborhood, it is necessary that they deal with this issue. The strategy of the responsible organization is the implementation of environmental management and its tools. It is needful to realize that it is not only the elimination the negative consequences of its activities. The organization should respond to climate change in general and in compensation of its activities should also develop measures that the environment is renewed.*

Keywords: *environmental, organization, green infrastructure, environmental management*

1. Ecology and organizations

Ecology is a very frequent topic in our society nowadays. Because life on our planet is primarily dependent on healthy natural ecosystems, it is essential that issues related to ecology became the core of political discussions. Among the most important problems in this area that have a negative impact on human life, we can also include climatic changes, weather fluctuations, increased mortality and diseases, soil degradation, exhaustion of natural resources, decline of biodiversity or wilderness and wildlife. The optimal conditions of the environment are directly proportionate to the quality of life and the level of human health. Thus, this situation is conditioned by harmless water and clean air, fertile soil, affordable resources and last but not least, increasingly necessary, green and blue infrastructure. Since the industrial revolution and rapid pace of technology development, it is the cause of negative changes in nature, especially human activity. Organizations are one of the distinctive negative elements for the environment. In the 21st century it is almost unthinkable that an organization wishing to succeed in harsh competition did not have the implemented attributes of environmental responsibility. Thanks to the European Ecological Convention, whose objectives by the year 2050 are to combat climatic changes and address environmental problems, will be organizations to face the largest environmental protection challenges.

1.1 Corporate social responsibility

In recent years, there is an increasingly attributed emphasis on the implementation of Corporate Social Responsibilities principles (CSR) in the field of environmental protection. It is a voluntary integration of social and economic interests in the daily activities of the organization implemented beyond the law, which are intended to contribute to sustainability and to obtain a competitive advantage on the market. Environmentally responsible organizations are monitoring their activities and try to reduce environmental impacts. The implementation of corporate social responsibility principles is a commitment to accept the strategies and decisions and to implement

activities that will be part of the objectives and values of the whole organization. In particular, it is necessary to focus mainly on:

Environmental management

Environmental management is one of the most effective tools to eliminate negative environmental impacts, especially in industry and service organizations. Those organizations that are interested in foreign markets can still be more likely to meet the requirements of the environmental quality of products and production, because environmental management is not a management system only focused on local and regional spheres, but also global ones. The basic environmental management tools include products-oriented tools and process-oriented tools. This management represents systemic solutions to environmental problems based on three principles:

- *Prevention principle* - prevention of negative impacts
- *Integration principle* - applying measures at all levels of organization,
- *Principle of caution* - monitoring and exploring long-term efficiency.

Environmental Managements Systems

Environmental management systems are economic management instruments in the field of ecology. The goal of their introduction is to create assumptions for financial sustainability and increasing economic performance, obtaining competitive advantage and sustainable development. Slovak organizations use the globally recognized standard ISO 14 001 and the European standard EMAS (Environmental Management and Audit Scheme). Obtaining ISO 14 001 certificate is subject to compliance with specific requirements that the organization declares a statement and also requests an accredited certification organization to be granted to. EMAS requires the publication of the environmental administration in which there are also the objectives of environmental policy and activities leading to their achievement, description of the environmental

management system and an overview of relevant data that are pollutants, waste, raw material consumption, noise level and other. EMAS has more stringent demands such as ISO 14 001 because it is supplemented by stricter requirements for measurement, assessment and constantly improving environmental behavior, to comply with the requirements set, the comparability of environmental behavior (benchmarking), involving all employees of the organization, public of relevant information and to verify an accredited environmental organization. EMAS is considered as the most confident tool in the field of environmental management systems.



Figure 1: Logos of Environmental management and Audit Scheme & Certification of Environmental management

Elimination of negative environmental impact

In recent years, little research has been implemented that says we need to reduce the negative impacts of organizations to the environment, as it was found that every year dying on diseases related to the adverse environment of about 1.5 million people. This represents 16% of all deaths that could be avoided, or it was possible to eliminate their causes. Only 3 million probable pollution wellheads were found in European Union countries. Number of environmental loads found let us say polluted sites are approximately 1.8 million. Elimination of negative consequences on the environment concerns not only the current impact of human activity, but also the past. At the beginning of industrial production, it was an absence of environmental managements therefore the wastes were accumulated and uncontrolled in the air, water, soil. Often there were industrial organizations located in vulnerable areas. Their harmful activities had an impact on the entire society, as the toxic substances received directly into the soil or sources of drinking water. The environment into which pollutants were absorbed in the past are still contaminated. The negative effects of the damaged environment will not show up on human health immediately. That's the reason why a lot of people do not show large respect to the impact of human activity. Therefore, support for experts in the distribution of environmental education, as well as in promoting and implementing appropriate measures, resulting in the conservation and revitalization of the environment for future generations is necessary.

Effective Waste Management

We can define a waste management as a set of activities aimed at:

- Waste prevention and limitation,
- Elimination of environmental waste hazards
- Reducing the overall effects of resource use,
- efficient waste management,
- increasing resource efficiency.

In accordance with these objectives, the effective waste management is a subject to a certain sequence, which means that it shows as the following hierarchy:

A. Waste prevention

Waste prevention is the primary intention of waste management. These are measures that are implemented before the substance, material or product will become waste. The amount of waste is eliminated by waste prevention, for example by reuse or extension of life. It also reduces the negative impacts of potential environmental waste and human health. Measures that are based on this primary objective are, for example:

- information and education of employees in environmental area,
- implementation of EMS/EMAS,
- application of environmental principles into operation (eco-design, innovative production processes, green public procurement),
- analysis and evaluation of the effectiveness environmental measures,
- introduction of backup (packaging),
- support the “zero waste” lifestyle and projects,
- composting and so on.

B. Preparation for reuse and waste recovery (for example energetic)

Reuse preparation we understand waste management associated with their control, cleaning or repair so that they are ready for further use, let us say evaluation. Waste recovery may be its use as fuel (energy appreciation) or production of new products or materials (recycling).

C. Recycling

It is a process leading to further use of waste and so saves natural resources, energies and avoids the environmental pollution by material that would otherwise become waste. Effective recycling and preparation for reuse is preceded introducing the right waste sorting as well as proper waste management in organizations. When the organization had to dispose of some waste, it is important to choose a certified company that emphasizes the ecology in the field of further loading and disposal of waste, but also the organization had to verify and control its activities and facts.

D. Disposal

Waste disposal is the last possible waste management alternative because it is, for example, dumped, waste incineration (not energetic), drainage to water, storage.

Reducing material and energy performance processes, protection of natural resources

This area involves reducing energy and water consumption, minimizing the use of fossil fuels, but also the use of alternative energy sources and use of so-called. BAT (The Best Alternative Technologies), let us say highly efficient and ecological technologies.

Implementation of environmental responsibility in the organization's working environment

In order for all ecological measures in the organization to work, it is necessary that employees with this philosophy become familiar with and identified. Environmental policy of organization should not be just an image outwardly, it should be closely linked to everyday activities, internal values and strategies. Only if there is a collective ecological mind, it is possible for the organization in this area to progress. At certain time intervals (for example quarterly, per year), it is advisable to realize an evaluation of the organization's environmental performance and to resolve the future routing based on results.

Elements of green and blue infrastructure

Green and blue infrastructure represent a concept that is environmentally friendly because it offers solutions for grey environment, let us say the urbanized environment we live in. It can be for example collision water management, noise and dust reduction, quality of environment and its esthetic adjustment rising. This infrastructure consists of greenery (trees, parks) and water (water surfaces, wetlands) that are planned and sustainable. Building this infrastructure, its revitalization and recovery are a great challenge not only for organizations.

2. Implementation the elements of green and blue infrastructure

Green together with blue infrastructure are also defined as a strategic network of natural and semi-natural territories, elements or areas that improve environmental health and contribute to biodiversity protection. It has a multilateral character and its goal is to increase the quality of life with using environmental, social and economic potential based on effective use of natural resources. It represents natural solutions that typically exhibit a high return on investment. This infrastructure is supported and protected by strategic and coordination initiatives aimed to creation and maintenance. The elements of green infrastructure are used primarily as climate change measures and blue elements are positively influence to improve water retention.

1.2 Green elements in organization

Green elements offer effective tools for recovery and revitalization of the environment. In the urbanized country, these elements may also be associated with the so-called gray infrastructure. Building green elements has several positive influences in built-up areas:

- Elimination of temperature differences,
- positively affect air temperature (trees with dense crown only result in only 2-5 % sunlight),

- oxygen formation (1 hectare green produces 21 tons of oxygen per year),
- absorbing the air pollutants,
- one adult tree absorb the lead, which was created by burning a 130th petrol hectoliter,
- The greenery acts as a dust particle filter (20 g of dust per m² of green surface),
- Positive impact on air humidity (water evaporation: 2.15 mm per m²),
- capture of precipitation.

The conference conclusions show that the green infrastructure and its elements represent an irreplaceable feature in society. Especially during the ongoing climate crisis having been already declared by the European Parliament in 2019. Their implementation is especially important in the urban environment, which also includes organizations. These should at least compensate for their negative effects on the environment through careful planning and construction of elements of green infrastructure. They can focus on:

- *planting trees* - it may be to build spot elements of green infrastructure when we can talk about planting separate trees or smaller groups of trees, whereas that's generally long-lived, slowly growing species that become a dominating organization's complex. The second option is the realization of forefront and tracked elements of green infrastructure, including alleys, avenue, circumferential greenery of areas, windbreaks, and bio corridors. For industrial and agricultural organizations, the circumferential greenery along the premises, is very suitable as it reduces the negative impact of production on the surroundings and adjacent surfaces. The aim of forefront and tracked elements is to draw attention to its routing to a particular point in urban or landscape environment or contrariwise to affect as masking of disruptive factors. At both it is important to decide for the types of trees that are well adapted to the country's climatic conditions. However, point elements operate as stationary orientation points and forefront elements bring their disposition to space the dynamics that determines the movement of the visitor.
- *green roofs* - it represents a system of vegetation and technical components that are built on the construction structure. Their purpose is to fulfill three interconnected tasks: ecological, economic and urban. It is an important aesthetic and functional element that provides space for various plants and animals, while having a positive impact on biodiversity, but also on human health. They positively influence the climate, eliminate dustiness, serve as noise insulation and also thermal insulation of buildings (in winter prevent heat from buildings from buildings and on summer protect against them by overheating). Green roof hold back approximately 75 % rainwater and thus eliminate the encumbrance of sewerage. Also, they contribute to improving air quality by reducing CO₂ concentration and produce oxygen (1 m² of green roof captures 5 kg

CO₂ per year). In addition, they capture contamination that are part of rainwater (lead, zinc, copper) and thus the water quality in the area make better. From the point of perspective of used green and subsequent considerateness, we differentiate extensive and intensive green roofs.

- A. **Extensive green roofs** consist of more resistant green, which is less demanding to care and maintenances (bryophytes, grass, herbs, perennials, stonecrops). The organization for this type of roofs will spend lower costs and can build them on flat and oblique roofs.
- B. **Intensive green roofs** are economically and technological more challenging because they are more strapping and heavier. They use all kinds of vegetation (lawn, woody species, perennials) that necessitate regular maintenance, including irrigation system. Their realization is only possible on flattened roofs.

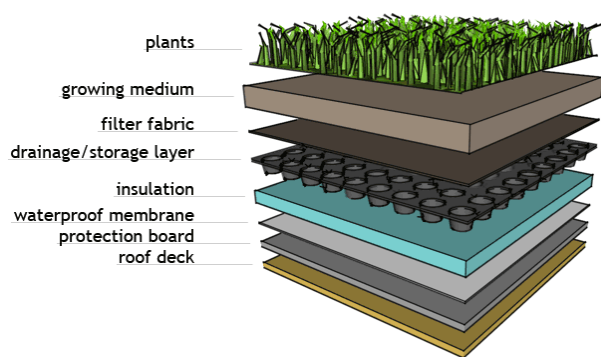


Figure 2: Sustainable Green Roof

- *vertical greenery* - it represents the green facades of buildings whose task is to reduce extreme fluctuations of temperatures, attenuate noise and cool air. It is also aesthetic and functional element that affect positively on a person's psychic. Provides space to many plants and animals too. It is a greenery associated with the ground, especially by the facades of houses, enclosure, walls (wisteria, ivy, grapevine), vertical greenery associated with frontage and mixed forms of vertical greenery (flower pots on terraces and balcony).

1.3 Blue elements in organization

Building a blue infrastructure introduces the measures in the field of water, which is primarily targeted to retain rainwater at the place of precipitation and return it to the atmosphere for the natural supplement of groundwater, with the help of:

- *bio-retentive system* - so called rain bioclimatic gardens represent planned depressions that capture rainwater, escaping from solid impervious surfaces such as sidewalks, roofs, car parks, roads that would otherwise discharge out, for example in sewerage. Therefore, it prevents the land drainage. It is a targeted creation group of plants that have not only organic function (ensuring filtering and evaporation), but as a floral flowerbed, aesthetic too. The effectively built rain garden allows water drain up to 48 hours.

Positive acquisitions of bioclimatic gardens are primary:

- A. Filtration of pollutants that could be exhausted into underwater or could escape the sewer,
- B. retaining rainwater from the environment that contributes to the elimination of flood risk,
- C. Filling groundwater,
- D. Positive impact on microclimate,
- E. Cooling the environments.,
- F. offers shelter for various animals.

There are many laws that describe a way to handle with rainwater in Slovakia. For each organization, the escape of rain water is unnecessary expenses from solid surfaces. Based on the European Union's decisions, the sealing of the territory (asphalting, roofing) that causes non-leaving rainwater at the place of their impact and non-waste into watercourses, is charged. Therefore, for organizations, also from an economic reason, build water retention measures, for example, in the form of rain gardens. In the selection of suitable green elements, the organization is generally decided mainly on the basis of their functionality, let us say their efficiency and aesthetic action as well as the nature of the surroundings where they are situated. Based on the ecological perspective, we evaluate, in particular, whether they are suitable for the environment (climate, soil conditions) and are sufficiently resistant.

- *grassy swamps* - They represent vegetative channels for transferring surface water for, which is intended to drain roads, trails, car parks. They contribute to reducing the volume of drain and improving water quality.
- *retention pond* - that's ponds or pools designed with additional storage capacity to attenuate surface runoff during rainfall events. They consist of a permanent pond are with landscapes banks and surroundings to provide additional storage capacity during rainfall events. They are created by using an existing natural depression, by excavating a new depression or by constructing embankments. Retention ponds have good capacity to remove urban pollutants and improve the quality of surface runoff.

The country we live in, we succeed after the predecessors and finally pass it by further generations. In what condition is only up to us. Organizations should understand the necessity of implementing environmental measures. We are all part of the ecosystem whose irreversible damage will have a global impact on the entire society.

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START-UPS AND INNOVATIVE SMALL AND MEDIUM-SIZED ENTERPRISES IN SLOVAK BUSINESS ENVIRONMENT

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Abstract: *An active part of the countries' economies is the private sector, a generator of effective development. From research, development, production process, marketing to the final materialization of products, business activity represents a broad basis of processes. The result of this process is the satisfaction of customer needs and the achievement of business prosperity. In the second decade of the 21st century, the business environment is characterized by the dynamization of processes, permanent changes in the market's structure and profile, and significant competition between individual entities. All types and forms of business entities enter the competitive struggle. In addition to large companies, small and medium-sized enterprises also compete, which are more sensitive to external changes, but at the same time flexibly adapt their business activities to new situations. Under these conditions, companies that come up with new ideas and improvements and can anticipate modern customer needs can succeed. This paper aims to point out the activities of innovative small and medium-sized enterprises and start-up initiatives in the Slovak business environment. Methodologically, we use classical scientific procedures, and in the end, we define the most important findings with proposals for the future.*

Keywords: *entrepreneurship, small and medium-sized enterprises, start-ups, innovation, business environment*

1. Introduction

Many times we find it difficult to define business as an activity. Note that this term is not defined from an economic, legislative or another point of view. Instead, it is a content-practical aspect of the expression and explanation of this concept. In such an economy, which operates based on a market mechanism in the spirit of Adam Smith, entrepreneurship is a genuinely irreplaceable activity for the life and operation of a particular economy. The most significant positive business is creating and subsequently materializing new thoughts or ideas about the company's surroundings. It is necessary to state objectively that the business environment in which the company is located can positively and negatively affect business activities. Larger companies do not feel fluctuations in the business environment as strongly as in the case of those business units that can be categorized into the small and medium-sized enterprise sectors.

Micro-enterprises, small and medium-sized enterprises come into a conflict not only with the internal but especially with the external environment, and the task of business management is to find a way to re-establish homeostasis. Thus, it can be said that there is a permanent interaction between the company and the business environment, between the company and other companies, between the company and customers, between the company and various organizations. This interaction in the market space then creates a situation where the company must look for opportunities for its organic growth. It is relatively optimal to carry out its research and development, which will help the company find and materialize a product for which customers have current demand on the market. The result of its research and development is then innovations that the business unit can implement almost immediately in its business activities

(production, sales, marketing, logistics, etc.). At present, innovation means purely new solutions and improvements, which means that an existing product or service is improved thanks to the company's innovative activities and brings the customer a higher level of satisfaction or a need that could not be met.

In this paper, we focus on innovation, among other things, because they are a real engine for business development, and in times of economic recession, they can help the company restart market success. The companies that make rare innovations certainly include the minor business units, micro-enterprises, and of these, emphasis should be placed mainly on the activity of start-ups. Start-up initiatives work based on a growth strategy, which helps them to progress despite the fierce competition present in the sub-markets and the entire market. From a macroeconomic point of view, innovative companies and start-ups can be assessed as instrumental economic entities. The big motto is their effort to spin the economy to contribute to developing mutual commercial relations. Here, of course, the existence and especially the entrepreneurial activity of start-ups and the smallest enterprises should be significantly emphasized among all organizational and legal forms of enterprises in the small and medium-sized enterprise sector. Naturally, even small to medium-sized enterprises contribute to expanding and implementing innovations; they carry out their research and development. However, their disadvantage is the difficulty and slower adaptation to changed conditions. Innovative entrepreneurship brings the desired effects for the companies that implement them and the region in which such a company operates. Small businesses are often closely linked to the regional economy, which is a significant benefit for the recovery of the regional economy in times of economic recession.

2. Theoretical background

Based on the introduction to innovative entrepreneurship and start-up initiatives, it can be synthetically stated that these entrepreneurial activities are desired and welcomed in all countries affected by the economic recession. Innovation can act as a magnet that attracts further innovations, and the company can reach a wide range of new customers. In the theoretical background of the set topic, we will take a closer look at the views of experts on this issue within the defined space.

The accelerated pace of competition requires not only maintaining but also developing the middle class represented by enterprises in the small and medium-sized enterprise sector. The expansion of the market has also brought new opportunities for micro, small and medium-sized enterprises. The global market intensifies competition between companies [4].

Through innovation, innovation is possible to increase entrepreneurship and create the right conditions for small and medium-sized enterprises to do business [6]. Creating an innovation profile is essential from the point of view of creating and implementing innovations into subsequent practice.

The integration of the Slovak business area into the EU area and globalization reduce barriers to the entry of Slovak small and medium-sized enterprises into new markets, but at the same time, competition is increasing [3]. The competitiveness of companies can also be built by introducing innovations, supporting innovative activities, which at the same time enables the expansion of companies into new areas. The implementation of research results through innovation into business practice can only be supported in development.

The team of authors [7] writes that small and medium-sized enterprises meet in comparison with larger enterprises with more problems, but innovation allows them to be more competitive. They can compete with other opponents. The use of innovation causes small and medium-sized enterprises to overcome these problems. For SMEs, innovation can vary and manifest itself in the organizational, local and global scope. Other foreign authors also see the uptake of the SME sector in this spirit [2].

They undoubtedly consider innovation and innovative entrepreneurship [9] to be how the national economy marked by the recession can be revived. The most important carriers of innovation processes are companies in the small and medium-sized enterprise sector. Innovation also represents opportunities for organic growth. Current business decisions are largely influenced by the need to beat the competition and stay in the market. The impact of innovation and the innovative business environment on the company is significant because they directly affect the company's business behaviour.

Experience shows that although there are differences in the behaviour of different types of small and medium-sized enterprises, there are no significant differences. Micro-enterprises have different behaviours in the approach and intensity of innovation implementation, especially when it comes to start-ups. These are the most active [1]. In addition to the company's size, the implementation of innovations also affects the ownership and character of the company. Compared to non-family businesses, family businesses also have certain specificities in this area, but they are equally interested in finding and implementing innovations [5]. Innovation is also crucial to family growth on the path to economic growth [11]. Business incubators [8], in which start-ups, in particular, find comprehensive support, are a hatchery for innovation and promoting innovative practices. The attitude and intelligence of business managers are involved in managers' decision-making on innovation and the management of innovation activities [10].

3. Aim, material and methods

In the scientific contribution, the author thematically focuses on the business activities performed by business entities in the sector of small and medium-sized enterprises. The author pays special attention to the entrepreneurship of those small and medium-sized enterprises that focus on innovation and the implementation of innovation in practice. Significant representatives of these activities are micro-enterprises, start-up initiatives, small and medium-sized enterprises. In times of economic recession, special attention must be paid to those companies whose activities support the start-up of the country's economy.

The primary goal of this paper is to point out the activities of innovative small and medium-sized enterprises and start-up initiatives in the Slovak business environment. The secondary goal is to present selected important factors of innovative business of companies from the small and medium business sector.

For this scientific contribution, we could not use only secondary sources. From secondary sources, we reached for scientific articles, classical contributions, and those recorded in the prestigious databases WoS and Scopus. We also needed to find out the current state directly in the Slovak business environment, and therefore we conducted a questionnaire survey within the implementation of the VEGA project. We used one of the quantitative tools, which was the questionnaire. The research took place in several rounds, so we illustrate the partially obtained data and results from a specific stage of research in this area. We addressed the compiled questionnaire to companies from small and medium-sized enterprises from various regions of Slovakia. In the presentation of the results in this paper, it was four self-governing regions (Bratislava, Trnava, Nitra and Trenčín). A total of 296 questionnaires were included in the sample, but 24 questionnaires had to be excluded due to formal errors. The resulting group represented 272 business units.

Methodologically, we use classical scientific methods such as analysis, synthesis, deduction, induction, comparison. In addition to the textual presentation of the findings, we attach a graphic representation of the results for better clarity. We processed them using MS Office software. At the end of the article, we define the most important findings with suggestions for the future.

4. Results and discussion

In the last part of the article, the author summaries some results and a short discussion on them. The specifics come directly from the research field, where business entities from small and medium-sized enterprises were interviewed through a questionnaire. These companies carry out innovative businesses (small and medium-sized enterprises) or start-ups (micro-enterprises).

In the first graphic display, we can follow the structure of a sample of business entities from self-governing regions of Slovakia (Graph 1).

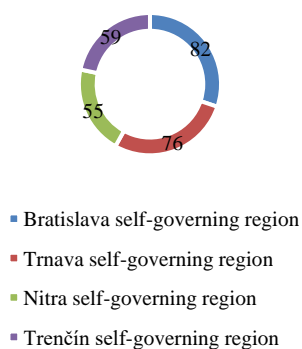


Figure 1: Sample of enterprises by regions

A partial sample from the Bratislava region in the number of 82 companies has a slight predominance. The second most numerous partial sample of enterprises was from the Trnava region in 76 business entities. From the Trenčín region, 59 companies were involved in the research, and from the Nitra region, 55 business entities participated in the research.

In order to implement innovations, business entities need the best possible business environment. A business environment is conducive to entrepreneurship if it is not too bureaucratic, complicated, stable, and stimulating. We, therefore, asked representatives of business entities participating in the research how they evaluate the Slovak business environment. We present our findings in Graph 2. Graph 2 shows the evaluation from the perspective of companies with six possible characteristics. Respondents had the following options: excellent, very good, good, average, terrible business environment. The results of the primary research showed that entrepreneurs do not evaluate the positive Slovak business environment. As many as 80 companies feel that the Slovak business environment is terrible. Another 72 companies rate this environment as bad. It does mean that more than half of

the respondents feel very negatively about the environment they have to operate in business. Fifty-four companies evaluate the business environment as average. A total of 66 companies evaluate the Slovak business environment in a positive spirit. Thirty-one business entities assess the Slovak conditions as a good environment. 22 companies described the Slovak business environment as very good, and only 13 companies described it as excellent.

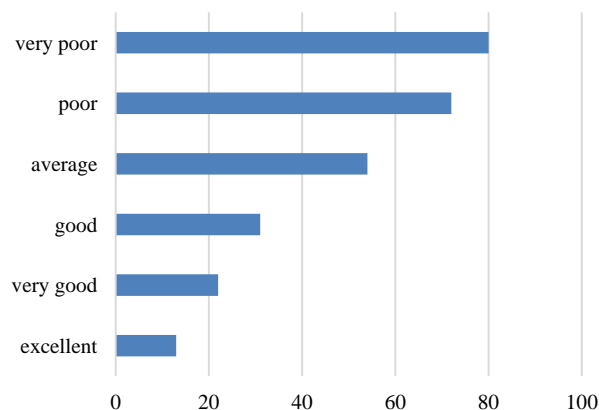


Figure 2: Evaluation of Slovak business environment

In the next part of our research, we asked respondents about all those related to their innovative business. In particular, we were interested in the areas in which companies implement the relevant innovations. Respondents were able to report several innovations at once, but a maximum of three types of innovations. The achieved score is shown in graph 3 below:

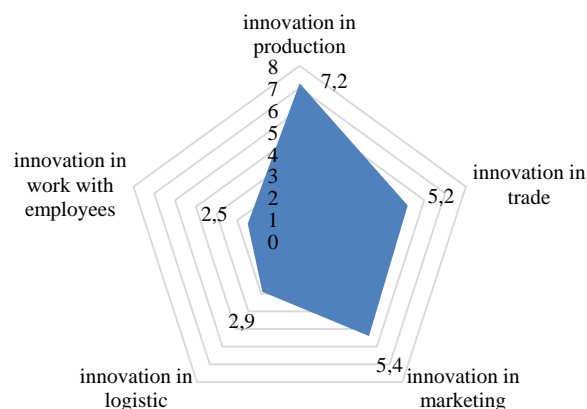


Figure 3: Areas of innovations

5. Conclusions

The dynamic base of national economies is small and medium-sized enterprises everywhere globally, as long as the country operates based on a market mechanism. Today, being successful is perhaps the most difficult in the last few decades, while the factors that fundamentally determine business success are an extensive base. When

competition between companies is at its peak, when the market is saturated, and when the economy has to cope with an economic recession, innovations and their implementation in practice are proving to be a possible alternative way out of the situation. Innovations can contribute to the satisfaction of hitherto unsatisfied market requirements or better satisfaction of customer wishes, which naturally impacts all activities in the entire enterprise system. Of the available business and organizational-legal forms, the most vital representatives of innovative business are start-up initiatives and micro-enterprises, which come up with excellent ideas on the market.

Our partial scientific research in four self-governing regions of Slovakia (Bratislavský, Trnavský, Nitriansky and Trenčiansky) on the final sample of 272 business units proved the necessary innovative ability of micro, small and medium-sized enterprises, including start-up initiatives and the fact that they are a significant contribution for the economic development of the country. Most innovations are implemented by start-ups and small, medium-sized enterprises in communication, marketing, information technology or improvement of production processes. We remain confident that these newer forms of business activity will be adopted by other entities, which together will contribute to the spin-up of the economy after the economic recession.

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THE PRINCIPLES OF THE E-WOM AND INFLUENCER MARKETING IN TOURISM

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Abstract: Online marketing has become very important in recent years and especially in the period of pandemics as everything has turned into online space. Word of mouth as typical for spreading information for people has also moved into the online environment. It is well known under the name e-WOM. People leave their comments and reviews online. Sharing such information is easy as well as access it. Active searching for reviews, reading them, and evaluating them has become an integral part of customers' decision-making process, especially in tourism. E-WOM is easily spreadable in the online environment and different social media make the whole process and access much easier. People who can influence other groups of people with their content (ideas, opinions, and experience with individual product and services) online has become an influencer in the different areas. Travel is not an exception. As long as traveling is accessible there are more and more travel influencers. The above-mentioned facts as well as many others are the reasons why it is considered to be crucial to determine the principles of e-wom and influencers in the area of tourism. The article points to the important theoretical basis of the topic and discusses the connection and practice in the field of tourism. The obtained data were qualitatively evaluated.

Keywords: online marketing, e-WOM, influencer marketing, tourism

1. Introduction

Social networks are a real phenomenon and a characteristic for the present and it is essential that managers and marketers pay enough attention to the topic. Also in business practice, they are able to use their potential to the maximum. In 2015, social networks had 1.79 billion active users. At present, it is 3.96 billion, which means that more than half of our planet is actively using social networks. The average daily consumption of time spent browsing and using social networks and applications is 2 hours and 24 minutes, and the average user uses up to eight accounts or applications. [1 p. 44; 2] Moreover, the number is increasing constantly. The surveys prove that the motivation of people to contribute to social networks lies in a combination of the following human needs: love; self-expression/emotions; sharing opinions/emotions; sharing opinions / influencing friends; showing off; entertainment / escape/entertainment; memories and nostalgia; making money. [3 p. 50] E-WOM and influencer marketing happening on the social networks thanks to the activity of the users and influencers has a huge impact on the shopping and business behavior in the online space. The appropriate setting out the principles and understanding them can improve the development in the theoretical level as well as in business practice.

2. Metodology

In obtaining the information mentioned in the article was used the method of document analysis. It was focused mainly on getting information from expert scientific articles. The data were processed by deduction and comparison methods. Conclusions from the analysis were then formulated by induction. Also, the following criteria were taken into account while selecting the analyzed documents:

- focusing on electronic word of mouth (e-WOM),

- focusing on online marketing,
- orientation on the tourism.

The topic is well applied in practice. Tourism is a sector where e-WOM and influencer marketing are applied worldwide as tourism is currently the eighth largest influencer marketing producer in the world. [24]

3. E-WOM

Word of mouth (WOM) as a human basic behavior has been playing the role of information dissemination. With the development of internet technologies, the WOM communication is not only through traditional way of face-to-face but also through online way. E-WOM has become a very universal phenomenon. [4]

Consumers consider WOM (word of mouth) to be a more reliable source of information [5]. Internet users exchange their opinions, ideas and comments about products or services, share their reviews of purchased goods and, based on these opinions, direct other users to purchase a specific service or product [6]

The difference from the ephemeral nature of traditional WOM is that eWOM exists in online space which can be accessed, linked, and searched. Given that travelers are relying more and more on search engines to locate travel information. Electronic word-of-mouth (eWOM) can be defined as all informal communications directed at consumers through Internet-based technology related to the usage or characteristics of particular goods and services, or their sellers. The information itself is visible and spreadable in text form, as a graphics, video or voice record. (podcasts, vlogs as well) and the most importantly they influence huge amount of people all over the world.[7,8]

WOM is especially important in tourism, where it is difficult to evaluate something without the direct experience of the consumer. The impact of WOM on the tourism sector has been shown to be particularly high due to the intangible nature of tourism products [9, 10]. Buying tourism products is associated with a higher risk, which leads to consumers relying on recommendations that mitigate the perceived risk of buying a product or service [11]. Travelers have access to tourism information, plan and book trips and share their travel experiences with their friends online [12]. Social media, review sites and travel blogs have made it easier to gather information on tourism and make decisions about travel itself.

e-WOM is divided to: a) spontaneous WOM - is an informal, unsupported way of shifting personal experience (for example in the form of a shopping board) from person to person. Its certain variant is the recommendation of the brand / product by satisfied customers through the so-called social shopping. This form is also called organic WOM, B) artificial WOM - created as a result of the activities of marketing departments of companies and specifically aimed at promoting WOM among people. [13 p. 268]

A good example of consumers sharing their hospitality and tourism opinions is the website tripadvisor.com – touted (by the company) as “the largest site for unbiased travel reviews which gives travelers the real story about hotels, attractions and restaurants around the world. [14] With more than 934 million reviews and opinions of nearly 8 million businesses, travelers turn to Tripadvisor to find deals on accommodations, book experiences, reserve tables at delicious restaurants and discover great places nearby. As a travel guidance company available in 43 markets and 22 languages. [15]

According to statista.com, in July 2021, the number of visitors to the travel and tourism website tripadvisor.com increased over the previous month, reaching roughly 172.5 million. During that month, tripadvisor.com - the global web page of the online travel company Tripadvisor - was the most visited travel and tourism website worldwide. [16]

3. Influencer marketing

According to Chandler and Munday influencer marketing can be defined as “a strategy of promoting a brand, product, or service with selected individuals who are expected to have a significant influence on purchasing decisions within a particular target market“. Although this method is similar to eWOM marketing, it does not necessarily have to be based on explicit recommendations. For example, a geotag or hashtag on a post published by an influencer, such as Instagram, may also affect an individual. [17]

Therefore, influencer marketing is also a form of advertising in order to gain attention. This marketing activity mainly benefits from the popularity of social

networks. Until recently, it focused exclusively on fashion, games and lifestyle products. Today, influencer marketing is justified in its specific form and form almost everywhere [18]

The use of social media has opened the door for businesses to interact and network with consumers online. [19]. Companies work with bloggers, celebrities, or other people with large numbers of followers as a way to reach their target audience online with the right message. [20] Influencers maintain a high position in their community and own the information they share with their audiences. Such influential people influence consumers more than traditional advertising, which subsequently led to a new way of marketing - influencer marketing. The use of influencer marketing is an extension of WOM [21], which influencer presents to the audience. The desired result is that the recipient will have a positive view of the report, thanks to their relationship with influenza. [22] With the development of the Internet, social networks, and online communities, this influence has shifted from celebrities and professionals as indigenous influencers [23] to social media, where anyone can become an influencer. [24] Celebrities remain in the digital environment and professionals in the sector continue to be influenced if they are highly active on social networks and are in some cases willing to use a form of sponsored content.

Influencer marketing in tourism is a relatively new method, but it is already an established part of brand marketing strategies around the world. Tourism is currently the eighth largest producer of influencer marketing in the world. [25] One of the reasons why surveillance of influencers in the field of tourism is so popular is due to the increased interest in travel in general, given that travel is much more accessible than in the past.

Influencers can currently be found mainly in the online environment, especially on platforms like YouTube, Snapchat, Instagram, or TikTok. Based on usage social media, it can be said that influencers are predominantly representatives of Generation Y or Z, which are people born since 1980. The main characteristics of these generations on social media is knowledge of technology, self-sufficiency, a high level of social contact with the company and the desire for flexible working conditions. These influencers have mostly high attendance and the basic driving force is their social community media, the will to produce and share relevant content for their fans. [25]

Influencers in the field of tourism create content focused primarily on visiting a new place and gaining experience. While some influencers started out as people who liked to travel and showed it on social networks, some influencers started going to new places because they saw it as an opportunity for their personal brand. Regardless of the intention, influencer marketing in the field of tourism is currently so popular that various brands have begun to notice this, who could use the potential cooperation with

influencers to develop their travel industry. These types of influencers promote their travel experiences and encourage their audiences to experience a similar experience themselves. They use their authenticity to make their audience feel connected to them and to show their level of commitment.[26]

The latest report made by Socialbakers.com claims that in terms of countries, the United States and Italy lead the world in Instagram travel influencers. Oposite UK is coming in the near bottom of the list and India is being last. India. Other interesting tidbits from the report: the majority of travel influencers on Instagram are either 25 – 34 years old or 18 – 25 years old. Additionally, 60 percent of them are female. In another interesting twist, travel brands are not the kind of brands travel influencers mention most. Instead, they tend to focus on fashion, beauty, ecommerce and retail. [26, 27]

6. Main conclusions

The field of e-wom and influencer marketing offers a wide range of scope for scientific exploration. In this article, the focus has been made on the link with tourism. As it, directly and indirectly, can influence the perception and reputation of the current object in tourism. Mostly it a destination and typical service.

Managing E-WOM in tourism is crucial because of the nature of the travel products. Buying travel products online takes a higher risk and which leads to consumers relying on recommendations. The worldwide leading travel reviews site is tripadvisor.com that is leading in reviewing travel products and services since 2008. However, social media and especially Instagram is also very popular among travelers. Social networks, as the platforms with enormous attendance and customers concentration, are natural environments for the managing of the artificial e-WOM. Marketers of the travel brands should manage the e-WOM and respond actively and diplomatically to the positive reviews and especially to the negative ones. As well as supporting spontaneous e-wom is welcome. Creating and managing e-wom of the current travel object is considered to be a crucial part of the brand building nowadays.

Managing e-wom is possible with collaborations with travel influencers. However, practice proves that travel influencers do not primarily cooperate with the travel brands, opposite, the cooperation is happening mainly between the product different brands (cosmetics, food, technologies). Nevertheless by using the hashtag and geotags while traveling the travel influencers indirectly raise awareness about the individual destinations or travel brands they have connected with somehow while traveling.

The principles of the e-wom and influencer marketing in tourism are the following:

Influencer marketing is the trending form of creating, spreading, and sharing e-wom in the online environment.

E-wom in tourism is long-term collected and distributed on tripadvisor.com. Each travel brand should manage its e-wom and reputation on this platform.

E-wom and influencer marketing are mostly applied on social media. In the field of tourism, the most preferred and used social media worldwide are Instagram, Facebook, and Youtube.

E-wom is accessible on social media in the form of text, comments under the photos, photos (as proof), video (short: stories or reels or long ones).

Most of the travel influencers are people from generations Y and Z, mostly young women. And influencer marketing is also natural for this generation as they are the consumer on mentioned social media.

Managing e-wom and influencer marketing should be utilized in the goal of travel brand building and it should be applied at the same time, as managing spontaneous and artificial e-wom.

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THE PECULIARITIES OF LEGAL REGULATION FOR LIGHTING PRODUCTS IN EUROPEAN UNION AND LITHUANIA

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Abstract: According to European Commission regulation the eco-design requirements for light sources and separate control gears should be implemented and regulated properly, without entailing excessive costs for energy-related products which account for significant number of sales and trade in countries are making a huge impact to environment. Pursuant to European legislation policies, there are huge necessity for EU regulatory actions due to managing long lasting problems of reducing e-waste, empower consumers to make reasonable and sustainable choices and allow EU citizens to take initiative in managing sustainable and rightfully functioning internal markets. Therefore, this article analyzes the peculiarities of the legal regulation of European Union and its implementation solutions in the Republic of Lithuania seeking the goal to achieve e-waste reduction, understanding of existing e-waste problem of society and government activeness on decisions making in the field of e-waste management in the process. The main purpose of this paper is to investigate whether Lithuanian legal legislation corresponds and seeks the purpose indicated in EU regulation and resolutions of implementation of toxic-free environment and single lightning efficiency. The Qualitative document and comparative data analysis are used to identify the problems and propose the probable solution considering improvement of implementation of legal regulation for lighting products in the Republic of Lithuania to seek the target of toxic-free environment and sustainable climate neutral and circular economy.

Keywords: Legal, Lightning products, toxic-free, environment, Lithuania, e-waste.

1. Introduction

The date of 1 of September 2021 was marked as the deadline to comply with new requirements of the European Single Lighting Regulation 2019/2020 [1] and the related Energy Labelling of Light Sources 2019/2015 [2], therefore, the lighting industry should be prepared and aware of the new changes, which have to be implemented in all Member states of European Union (further – EU). The Single Lighting Regulation (further - SLR) now requires, that lighting products comply with the ecodesign requirements established in three directives: (EC) No 244/2009 [3], (EC) No 245/2009 [4] and (EU) No 1194/2012 [5], thus the current regulation should combine all three existing regulations and indicate the requirements for all lightning products, that will fall within the scope. The terms of lamps and luminaires have to be replaced by light sources and containing products, therefore other amendments due to terms were also indicated in new legislation of EU. The main environmental effect of lightning products changes, have been identified as important energy consumption in the use phase along with mercury content [1]. Thus, the exemptions of this regulation will be applied to light sources with special technical features for use in specific applications, including related to health and safety and which higher energy efficiency alternatives are not available or not cost effective.

It should be noted, that also a simpler EU energy labels for lighting products applicable from 1 of September. According to the European Commission press release made on 31 of August 2021 as a support for consumers to

cut their energy bills and carbon footprint, a new version of the EU energy label for light bulbs and other lighting products will be applicable in all shops and online retail outlets [8]. The actions indicate the considerable improvement in energy efficiency, which constitutes, that more light sources, such as light bulbs and LED modules, will achieve label ratings of A+ or A++ according to the current scale. The most important change will be the return to a simpler A-G scale. Updating labels will benefit for consumers to see what are the class products, which could help them to save energy and money on their bills. According to EU Commissions statement “Using more energy efficient lighting will continue to reduce the EU greenhouse gas emissions and contribute to becoming climate-neutral by 2050” [8]. For online sales, the old labels displayed online will have to be replaced by the new ones within 14 working days, thus for non-online sale the term for implementation of replacement of old labels is up till 18 months. Today's measures follow a rescaling of the energy labels for 4 other product categories – fridges and freezers, dishwashers, washing machines, and televisions (and other external monitors). Also still are waiting for updating the labelling for products including tumble dryers, local space heaters, air conditioners, cooking appliances, ventilation units, professional refrigeration cabinets, space and water heaters, and solid fuel boilers, and considering the introduction of new energy labels for solar panels.

It should be mentioned, that light source technologies keep evolving, thereby improving energy efficiency. LED modules, which are for almost all applications the most

energy efficient lighting technology that exists, have had a rapid uptake on the EU market: from 0% of lamps sold in 2008 to 22% in 2015 [1]. The average energy efficiency of LEDs quadrupled between 2009 and 2015, and prices dropped significantly: compared to 2010, in 2017 a typical LED lamp for household use was 75% cheaper and a typical LED lamp for offices 60% cheaper. It is estimated that approximately 1500 million light sources were sold in the EU in 2020 – but this figure is likely to fall to 600m in 2030 (down 60%), even though the number of light sources used will rise by more than 17%. This is because of the greater energy efficiency and in particular the longer lifetime of LED light sources. Therefore, the Commission's impact assessment of the new rules indicates, that the changes will save 7 million tons of CO₂ equivalent a year by 2030, relative to a business-as-usual scenario without any EU eco-design measures.

2. EU legislation requirements for lightning products

The new categories for the rescaled label were agreed after a rigorous and fully transparent consultation process, with the close involvement of Member States at all stages, and scrutiny by the Council and the European Parliament and with sufficient information provided to manufacturers with the new rules agreed in 2019. As required by the new regulation, other product groups will be rescaled in the coming years such as tumble dryers cooking appliances, ventilation units, space and water heaters, and solid fuel boilers. The EU energy label is a widely recognized feature on household products, like light bulbs, televisions or washing machines, and has helped consumers make informed choices. In an EU wide survey in 2019, 93% of consumers confirmed, that they recognized the label and 79% confirmed that it had influenced their decision on what product buying choices. Together with harmonised ecodesign, EU energy labelling rules are estimated to cut consumer expenditure by tens of billions of euros every year, generating multiple other benefits for the environment, manufacturers and retailers [6]. The Europeans Commissions (EC) goal is to motivate manufacturers to commit to a more circular economy approach and comply with seeking the aim to the better future environment. Now, a luminaire with a nonreplaceable LED module becomes a light source with all the consequences formulated in the regulation. Thus, lightning products should be adhered to certain removability and replaceability requirements unless the manufacturer provides a technical justification of it. The documentation must include this technical justification, otherwise, the opportunity to sell the product in Europe will be prohibited. Additionally, various light source types have been phased out in the process.

It should be noted, that if a light source is nonreplaceable on a shelf, in an oven or in a refrigerator or appliances become a light source, that must be in compliance with the regulation. For most light sources, depending on the lumen output and color rendering index, which must be above 80 the minimum efficacy is now above 100 lm/W. The network standby power consumption must be less than

0.5W. More functional requirements are now defined by the displacement, lumen maintenance and survival factor for LEDs and organic LEDs. On the other hand, flicker and stroboscopic effects are also considered, as these requirements are beneficial in creating better light quality.

In case of control gear, a minimum energy efficiency at full load is formulated depending on the light source, type and wattage. In line with the above-mentioned SLR, a new regulation covers the energy labeling of the light sources. A rescaling of the existing energy label from A++ to E was overdue, and one from A to G has replaced it. For example, with the regulation now in place, nondirectional light sources are classified in group D or E. As with the SLR, the energy labeling regulation went into effect on 1 of September 2021. Consequently, luminaires should no longer be labeled regarding their energy efficiency. However, as of May 1 2021, all light sources will need to be labeled and registered with their technical information in the European Product Registry for Energy Labelling (EPREL) database. This requirement was already in place for lamps being marketed in Europe and is now being extended to the light sources. If a manufacturer decides to market a luminaire with a nonreplaceable LED module, it must be registered as a light source. Even if an appliance or furniture manufacturer decides to use non-replaceable modules, these products must be registered by the time the database is available. In this way market surveillance authorities can review comprehensive information about a product. End users get access to the public part of the database to learn about the product, therefore, the new scale is stricter and designed so that very few products are initially able to achieve the ratings, leaving space for more efficient products to gradually enter the market. "The most energy efficient products currently on the market will typically now be labelled as "C" or "D". A number of new elements will be included on the labels, including a QR code that links to an EU-wide database, where consumers can find more details about the product" [6].

Today's measures follow a rescaling of the energy labels on 1 March 2021 for 4 other product categories – fridges and freezers, dishwashers, washing machines, and televisions (and other external monitors). Building on EU ecodesign rules, the European Commission is also working on updating the labelling for products including tumble dryers, local space heaters, air conditioners, cooking appliances, ventilation units, professional refrigeration cabinets, space and water heaters, and solid fuel boilers, and considering the introduction of new energy labels for solar panels.

3. Peculiarities of legal regulation implementation for lightning products in Lithuania

It should be noted, that in Lithuania, after establishing 2009 directive considering lighting products ecodesign requirements, additional research and implementations methods of such regulation were investigated. A study by Vilnius Gediminas Technical University identified ways and methods to implement technical regulations and

indicated the main practical issues of its execution in Lithuania [7]. The research showed, that combining different light composition solutions in a room, it is important to take into account the intended use of each light source and the quantitative and qualitative parameters of it. The research results also indicated, that it is recommended to educate the society more intensively in Lithuania, as there is a relatively high level of passivity of the society on this issue, so it is necessary to raise awareness of innovative lighting systems indicating it as a feature of human psychological factors, which could have a psychological impact on the human body as well, not just to the environment. It was also suggested, that designers should become active creators of the legal environment and participants in the whole system, and that sociological research should be expanded and deepened in order to identify the objectives communities' expectations when upgrading LED lighting systems in residential dwellings.

In order to implement the strategy and objectives set by the EU in the 2009 Directive, Lithuania has adopted the relevant legislation to ensure, that the legal framework is consistent with the achievement and proper implementation of the objectives, set out in the EU legislation. The main legislative changes were related to the implementation of legal acts applied in the recommendations to the State Long-Term Development Strategy [9], the National Programme for the Implementation of the Lisbon Strategy 2008-2010 [10], the State Long-term Development Strategy and the Republic of Lithuania Innovation Strategy 2010-2020 [11], the National Strategy for Sustainable Development [12], the National Programme for the Improvement of Energy Efficiency [13], the National Programme for the Improvement of Energy Consumption provisions of the Energy Efficiency Action Plan 2014 [14]. Main reference was made to the main Lithuanian documents regulating lighting the hygienic standards which were amended in 2014 [15]. These regulations implemented requirements for natural and artificial lighting in workplaces, illuminance limit values and general measurement requirements, building regulation.

It should be noted, that together Chemicals Strategy for Sustainability, the action plan puts into practice the EU's zero pollution target for a toxic-free environment in Lithuania. It is linked to the EU's objectives on climate neutrality, health, biodiversity and resource efficiency, and builds on initiatives in the areas of energy, industry, mobility, food, circular economy and agriculture [20]. In 2021 EU Green Week was the biggest annual event on environmental policy, providing an opportunity for citizens from across the EU to discuss various aspects of zero pollution at a major conference in Brussels [21]. Lithuania has also recognized, that pollution is a major environmental cause of a wide range of mental and physical illnesses, as well as premature deaths, especially among children, people with certain diseases and the elderly. People living in poorer areas often live close to polluted areas or in areas with high traffic flows. Toxic-free environments also play a significant role in protecting

our ecosystems, as pollution is one of the main causes of biodiversity loss. It weakens the ability of ecosystems to carry out functions such as carbon sequestration and air and water purification.

It should be mentioned, that according to the latest European Environment Agency report on health and the environment, more than 400 000 premature deaths and 48 000 cases of ischemic heart disease and 6.5 million cases of chronic sleep disorder are attributed to ambient air pollution in the EU each year, not including other diseases linked to both factors [25]. The EU has already set a number of pollution-related targets. Existing legislation on air, water, marine and noise sets environmental quality objectives, and many pieces of legislation address pollution sources. Therefore, to help meet biodiversity targets, the EC has published a series of priority targets for reducing nutrient leaching and pesticide use in the farm to table strategy and the biodiversity strategy [22]. Therefore, analysis of Lithuanian legal legislation in the field of EU strategies implementation, indicated, that according to conclusion of Committee on European Affairs and Committee on Foreign Affairs (further – Committees) on the priorities of the Parliament of the Republic of Lithuania under the EC Work Programme 2021 [23], Lithuania approves the Sustainable Products Policy Initiative, the review of the Ecodesign Directive will be implemented by means of a legislative act, including an impact assessment. Due to the basis of the consolidated version of the Treaty on the Functioning of the EU and the provisions of Article 114 [24], which states, that if there are any of the harmonization provisions indicated by EC, a Member State considers, that for important reasons or relating to the protection of the environment it is necessary to maintain national provisions, it shall inform the EC of those provisions and the reasons for maintaining them. These steps are foreseen within the fourth quarter of 2021, and the circular electronics are to be pursued by means of a legislative act in Lithuanian lawmaking as well. It should be noted, that according to approved conclusion of the Committees, it was pointed out, that the Circular Economy Action Plan is supported to move towards a climate-neutral economy, which requires a new approach to the use of products and raw materials and Lithuania agrees that sectors such as plastics and electronics need urgent action at EU level and leadership outside the EU, thus the importance of establishing requirements for cross-border shipments of waste should be taken into account, so that problems related to waste shipments are not transferred to third countries. It was also indicated, that the transition to a climate-neutral economy is linked to a new approach to the use of raw materials in products, as the environmental impact of a product is determined by its design, and therefore to the need to enshrine in legislation sustainability principles and measures to increase the use of recyclable-agricultural raw materials, reducing hazardous substances, therefore by reducing the content of substances of concern in products and recycled materials, through legal requirements, have to be implemented giving the priority to product categories, that affect vulnerable

populations and those with the highest circularity potential, such as textiles, electronics and furniture. The EU initiative, which also includes the Chemicals Strategy Action Plan, is highly relevant for Lithuania. The Lithuanian submission points out, that less than 40% of e-waste is currently recycled in the EU, resulting in a loss of value for the sector's products, as most of them cannot be repaired, batteries cannot be replaced and software cannot be updated [24]. The argument was set out, that systematic breeding is needed to mobilize the created mechanism, and that it is important to take into account the durability of the product, its reparability, upgradability, reusability and its recyclability, in the process of designing products, in order to minimize e-waste generation, which in all actions must be taken into account.

Therefore, the conclusion of Lithuanian government on question of EU new regulations on lighting products and other regulations for seeking the EU goal to become a sustainable climate neutral and circular economy, has been approved by setting out new steps on preparing legal acts in Lithuania for implementation of EU new regulations. Thus, some arguments were provided, such as the financial support indications for implementing such goals, as well as question of effectiveness of such regulation if third countries do not increase their own ambitions and will not follow the practices and examples of EU legislation changes, therefore stating, that to achieve the results the changes have to be implemented globally.

3. The implementation of new chemicals strategy towards a toxic-free environment

Almost 20 years after the first strategic approach to chemicals management in Europe [16], the time has come to combine a new long-term vision for the EU's chemical policy. In line with the European Green Deal, the strategy pursues for a toxic-free environment, where chemicals are produced and used in a way, that maximizes their contribution to society, including achieving the green and digital transition, while avoiding harm to the planet and to current and future generations. EU new growth strategy, has set the goal to become a sustainable climate neutral and circular economy by 2050. It has also aimed to protect human health and the environment by tackling pollution from all sources and move towards a toxic-free environment. Therefore, taking into account, that the chemicals are a part of our environment these days, because consumptions of technologies and usage of a lot of devices to ensure comfortability is causing the damage to our environment and leading the society to health problems on the way. the increased investment and innovative capacity of the chemicals industry to provide safe and sustainable chemicals will be vital to offer new solutions and support both the green and the digital transitions of our economy and society [17]. The Commission constitutes, that this new legislation will lead to new approaches, such as the development of safe criteria for developed chemicals, facilitate business cooperation and information sharing, as well as technical knowledge on alternatives and innovation. It has to

noticed, that EC will provide financial support, and ensure the development and use of chemicals and other substances and products, that are compatible with sustainability principles, as well as address gaps, to ensure adequate skills levels enforcement, including vocational training and tertiary education, research, industry and regulators, and establish key performance indicators to help identify how industry is progressing in the transition to safe and sustainable production of chemicals.

Therefore, according to Lithuanian legislation, these requirements will be implemented accordingly the approved inventory based on Annex I "New Initiatives" of the European Commission's Work Programme for 2020. The approved inventory plan supports the goal of achieving a climate neutral economy by 2050. It is important, that climate and environmental objectives are integrated into all sectoral policies, that commitments do not reduce sectoral competitiveness, and that they take into account the capabilities and specificities of Member States. Thus, the Lithuania, according to the strategic plan, did not support changing/increasing the 2030 targets, as Lithuania will need 14 billion euros to meet the targets agreed so far. Without sufficient funding, it would be impossible to achieve them, let alone increase them [19]. The opinion of necessity of being cautious was addressed about the possibility of higher climate change commitments in the European Climate Law. Therefore, it is in Lithuania's interest that the EU does not unilaterally increase its commitments until 2030, if third countries do not increase their own ambitions. Thus, climate diplomacy needs to be strengthened and third countries should be encouraged to take more ambitious action, following the EU's example. While the EU's commitments are the most ambitious under the Paris Agreement, the EU's efforts alone will not stop climate change: increasing of ambition and its implementation is needed globally. It should be noticed, that Lithuania welcomes the EC's proposal for a European Climate Pact, thus it is important for Lithuania, that all Members and society are aware of their role in the fight against climate change and actively contribute to the achievement of long-term climate goals. Lithuanian government support measures to help Member States address the social and economic costs of the transition to a climate neutral economy. However, given the urgency and complexity of the climate change topic, the proposal for a new regulation assessed on a reserved basis, in order to strategically assess potential for integration of the new fund, synergies and other technical requirements, which may partly change the administrative and financial cost streams in the existing system of the EU Structural Investment Funds, the developed within the framework of Cohesion Policy, with a project to allocate EUR 97 million from the EUR 7.5 billion fund to Lithuania could be needed [19].

It is important that the European Green Deal pays sufficient attention to the integration of environmental and climate objectives into other sectoral policies and initiatives are sustainable and contribute to the

achievement of the objectives set out in the regulations. Lithuania agrees, that disclosure of the climate change impact of business models in companies' non-financial reports would encourage companies to seek a more climate-neutral business model, compete with each other on sustainable solutions and, consequently, encourage investment in sustainable business.

The EC indicates, that perhaps the biggest public health benefit of chemicals legislation in decades is the reduction in exposure to carcinogens. This has been achieved because EU legislation has taken a precautionary approach to overall risk management, with the aim of banning carcinogens in principle from most consumer products and, where they are likely to affect vulnerable populations, to apply limited exemptions under clearly defined conditions in legislation. This precautionary approach sends a clear signal as to the type of chemical innovation, that industry should prioritize and take new action course [18]. Although, it is difficult to provide a precise criterion, these initiatives are also likely to avoid inappropriate substitution. The EC is moving towards grouping substances as part of the risk management of chemicals, in particular the grouping, thus the Chemicals Strategy is expected to provide a future approach for the assessment of groups of chemicals with similar hazard, risk or function.

3. Conclusions

In the face of a global pandemic, the European Commission is not losing sight of one of its key priorities to handle climate change. According to new requirements of the SLR and the related energy labeling of light sources, the lighting industry and Member States should face the changes for seeking the goal of toxic-free environment. SLR requires lighting products to comply with the ecodesign requirements established EU, and the current regulation combines all three existing regulations indicating the requirements for all lightning products that fall within the scope of Regulation. The main expected environmental effect of new regulation is decrease of energy consumption along with minimizing the mercury content in these products.

The other important EU Strategy to neutralize the EU's climate change impacts by 2050 by improving the reduce the use of chemicals in everyday goods, which will help to narrow down not only negative impacts on the environment, but on health and safety of people as well, due to reduce carcinogenic diseases, with a particular focus on vulnerable groups.

In order to implement the strategy and objectives set by the EU in new regulations, Lithuania has adopted the relevant legal acts to ensure, that the legal framework is consistent with the achievement and proper implementation of the objectives set out in the EU legislation. The main legislative changes were related to the implementation of legal acts applied in the recommendations to the State Long-Term Development Strategy National Programme

for the Implementation of the Lisbon Strategy, the State Long-term Development Strategy, the Republic of Lithuania Innovation Strategy, the National Strategy for Sustainable Development, the National Programme for the Improvement of Energy Efficiency, the National Programme for the Improvement of Energy Consumption provisions of the Energy Efficiency Action Plan. Main amendments were made to the main Lithuanian documents regulating lighting hygienic standards in accordance with EU Regulation. These regulations implemented requirements for natural and artificial lighting, illuminance limit values and general measurement requirements, as well as requirements set out in SLR related energy labeling of light sources.

In order to meet the EU's climate policy objectives, Lithuania will need to reorient its economy towards a more sustainable one, which currently is being implemented in the legislation of Lithuania. Therefore, to exceed the set new goals, it will require not only public funds, but also private ones. Therefore, it should be pointed out, that that before applying possible market restrictions, such as a non-compliance requirement for products, or non-compliance with the chemical's strategy may be grounds for restrictions on the entry of products and goods into EU markets, a comprehensive impact assessment at EU, regional and Member State level should be prepared and evaluated. Thus, the restrictions and their implementation should be imposed only after finding the sustainable alternatives for it.

Lithuania have foreseen what next steps should be taken and added to the law-making, to comply with the new requirement of EC and accomplish set targets. Therefore, the circular electronics will be pursued by means of new legislative act in the current legislation of Lithuania. Thus, to move towards a climate-neutral economy, with a new approach to the use of products and raw materials in relevant sectors such as plastics and electronics needs an action not only at EU level but outside the EU as well, because the environmental change have to be applied globally to have an effect, so that problems considering toxic-free environment and climate change would not be forwarded to third countries. reducing hazardous substances content in products and recycled materials through set out legal requirements, have to be implemented giving the priority to product categories, that affect vulnerable populations and those with the highest circularity potential.

In practice, companies along the supply chain will need to assess the substances used in their products and actively seek alternatives. The grouping approach ultimately aims to increase the efficiency of restriction procedures, which have so far relied on single substances. This approach to risk assessment has been criticized for being resource-intensive and could not be always the most effective way to exceed for real change.

It could be noted, that Lithuania, has questioned the possibilities to achieve the set 2030 targets of EC, as Lithuania will need additional financing and investment to implement and fulfil the EU requirement and seek the indicated goals. Without funding, it would be difficult to achieve indicated aims in the EU new legislation toward sustainable climate neutral and circular economy, as well as toxic-free environment and sufficient energy efficiency. The possibility of higher climate change commitments in the European climate law should be taken with most of cautiousness, therefore taking more effort to strengthen climate diplomacy and encourage third countries to take more ambitious action, following the EU's example and change their own regulations accordingly, thus, the EU's efforts alone will not stop climate change without involving and implementing changes globally.

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MONITORING OF ECONOMIC AND ORGANIZATIONAL EFFECTS AND CREATION OF AN INTEGRATED MODEL ASSESSMENT OF CLUSTER FINANCIAL PERFORMANCE

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Abstract: *The presented article aims to acquaint the public with the results of partial research in the field of management and organization of industrial clusters with special emphasis on explaining the specifics of organizational structure, process management, economic and financial attributes and the current state of cluster development. It contains brief information on the integration and implementation of process management and to support its activities, the authors show their own integrated model for evaluating the economic efficiency, financial performance and organizational potential of clusters. The paper also includes the application of a methodology for diagnosing the economic efficiency of clusters and a short final summary of the issue.*

Keywords: *diagnostics, economic efficiency, financial performance, integrated evaluation model, process management*

1. Introduction

In the challenging competitive environment, only the most capable business entities benefit in the long run. As large corporations with extensive technical, material, personnel and financial background have the upper hand in this, it is difficult to create an advantage especially for small and medium-sized companies with insufficient innovation capacity and lack of resources. This results in current trends in merging and networking such companies and organizations into clusters and related research or educational institutions. [5]. Such groupings are much more efficient, flexible and resistant to external influences as compared to the classical hierarchical organizational arrangement. Their important weapon is the transfer of knowledge and information, communication and creativity of individuals, but also permanent self-education. In the professional literature, there is several relevant knowledge directly on the topic of process creation and key customers management, to which the portfolio of perception and differentiation must be adapted, and thus the whole essence of organizational culture and managerial structure. [3,9] Due to the creation of special-purpose clusters, the concentration and market dominance of companies that are interconnected in terms of products, marketing and development is increasing. Professor M. E. Porter defined the cluster as a geographical concentration of interconnected companies and institutions, specialized suppliers, service providers and partners in the given sector in order to operate in this business sector and to prioritize cooperation over competition. [4, 12]. It is actually a way of organizing the production, service and distribution system and the processes associated with it at various sophisticated levels..

2. Current state of development of industrial clusters in Slovakia

The concept of clusters in general can be included in a broader group of territorial innovation concepts with a regional impact on a given geographical area. Clusters are

a global phenomenon today because they have great local potential. However, many already have a global character and reach in several areas of business. [11]. Today, we can talk about two types of clusters, namely those that are based on the production value supply-customer chain of the final producer (such as automotive clusters) and then they are competency-based clusters, oriented to the application of specific solutions (such as IT technology).

In professional practice, clusters are also divided as follows[4]:

1. Material-oriented organizations (e.g. woodworking activity)
2. Product-oriented organizations (such as cars)
3. Technology-oriented organizations (e.g. laser research and technology)
4. Market-oriented organizations (e.g. services, sports, ...)
5. Problem-oriented organizations (e.g. ecology, ...)

Clusters create an environment for the effectiveness of relationships, regional action and development, but especially for innovation and the creation of knowledge and new solutions, which have an impact on economic performance and employment in the area of operation. They are proven innovators and movers of new ideas and solutions; they are knowledge-oriented, dynamic and combine the peculiarities of local and regional action in a new quality. They are much more willing to share and apply information about products and processes and significantly initiate the revival of small and medium-sized enterprises, which is especially important in the conditions of Slovakia. Also in Slovakia, after a certain delay, cluster groupings began to form and currently there are already 25 industrial clusters, most of which are engaged in various branches of industry, science and research, while the others are engaged in tourism in the regions.

3. Organizational structure, economic and process management of clusters

The organizational structure of clusters is actually a comprehensive system of elements (organizational units and units in a given hierarchy) and the links between them (organizational, technical, management tasks and rules of operation in a given environment in real time). It is actually a culture, management methodology and sales technique containing the main elements and these are the basic assumptions, values, standards of behavior, artifacts of a material nature and artifacts of an immaterial nature. Clusters work on specific things, carry out little research, rather only observe and operatively transfer ideas and concentrate experts always on only one project activity or topic, which is basically the principle of their existence and networking. The cluster must also pay attention to the relationship between innovation, market performance and the value of the investment that the project will bring to the customers. The goal of each cluster is to become so flexible that it is able to respond quickly with its entire apparatus to constant changes in the environment, customer needs and the behavior of competitors. However, the key is the ability to continuously improve the established processes. But this cannot be done without people, because the proposals and the improvement itself must always come from the people. [1, 12] Process, process management - is used in managerial and economic practice in several senses. A process is commonly understood as a process (e.g. a technological process, a law, a financial process). By this procedure, the authors "mean" a series of consecutive activities, where each sub-activity (elements of this series) is organized mainly functionally". [13] Processes, especially management processes and also production processes, play a key role among the components of the management model. In order for clusters to work, they must therefore define and manage a large number of interconnected processes. The organization and management of processes depends on how efficiently the activities leading from the acquisition of orders to their satisfaction are carried out, how complicated or logical are the auxiliary operations performed to the main processes. Table 1 defines the types of integration and interests as well as the principles of introducing process management into cluster structures as follows. [authors]

Table 1 Integration and implementation of process management [authors]

THE TYPES OF INTEGRATION AND INTEREST IN THE PROCESS APPROACH ARE IN:	THE MAIN PRINCIPLES FOR THE IMPLEMENTATION OF PROCESS MANAGEMENT CAN BE DETERMINED AS:
Operations integration - the basis for team management. At present, a versatile worker receives more attention than a one-sided, poorly educated worker.	Starting a new organizational cluster culture - to teach the whole team and management to think process. The process begins with training and teaching.
Integration of customers into the cluster production process. The customer can comment on how they want to have the	Review of the internal management system - elaboration of a new cluster strategy and the subsequent new creation of a new

product or service configured and only then gives a signal for production.	organizational structure
Supplier integration into the production process. The supplier becomes a direct part of production and services and is not just a supplier of individual components.	Redesign of management processes - elimination of unnecessary and duplicate activities; complementing missing activities and innovating inefficiently performed activities

4. Creating an integrated model for evaluating the economic efficiency, financial performance and organizational potential of clusters

Effective process management improves the ability of clusters to anticipate, manage, and respond to changes in market conditions to maximize business opportunities. Proper process management can also reduce low efficiency and errors due to information overload. Thus, it can be stated within the cluster research conducted by the authors that the implementation of process management is realized on the basis of their potential advantages and benefits, which are brought in with sufficiently effective selection and exclusion of potential disadvantages and risks associated with it. [6, 11].

In current business practice, even in the conditions of SMEs, financial management is much more demanding for cluster management, because much more needs to be focused on monitoring the ever-changing market and relevant business environment, and at the same time factors and responses (often with multi-year delays) from the global environment of economies and from the company's own past mistakes in managing the company, which have already been forgotten and only now are their effects clear. [8].

Current approaches to measuring the financial performance of SMEs are characterized by a greater number of methods and ways to measure and evaluate the financial performance of a business entity within the internal company methodology. According to Hyránek, Grelly and Nagy [10], two groups of measurements are applicable, namely:

- Analysis of financial performance using standard classical profitability indicators (ROA, ROE, ROI).
- Modern approaches preferring the growth of market value (return on net assets - RONA, return on gross assets - GROGA, cash flow return on investment - CF ROI, EVA indicators and modifications - relative EVA, EVA ROS, EVA Momentum, DEVA and others).

This needs to be followed up by comparing approaches in evaluating the financial situations of clusters in practice, both by methods of economic and financial analysis (ex-post financial analysis models and ex-ante financial analysis models) and by value management methods with a focus on EVA type indicators, based on the principle economic profit and market value. For the needs of a specific approach to performance evaluation with a special

position and the main criterion of diagnosis and evaluation of the examined subject from the aspect of innovative performance, it is possible to implement a standard VSMFR model or a modern VMMFR model as per Table 2. [authors].

Table 2 Specifics and essence of methods of monitoring and diagnosing economic indicators of clusters [authors]

<i>Model VSMFR</i>	<i>Model VMMFR</i>
<ul style="list-style-type: none"> - identification and selection of accounting input data of the analyzed cluster: from financial statements and annual accounting reports, - analysis, selection and calculation of standard economic indicators based on accounting profit, <ul style="list-style-type: none"> - sectoral comparison within organizations in the same sector on the basis of appropriately selected benchmarks, - analysis of the time series in order to identify the factors affecting changes in the analyzed financial indicators and trends in their development during period under review and using growth rates or indices of change, - determination of the dependent variable (EAT indicator) and independent variables (sales, costs, level 3 liquidity, net working capital, total indebtedness and GDP for industrial business output), - compilation of the function of multiple linear regression using a software solution and a description of individual relationships between selected variables, - regression modeling with the aim of predicting the future development of the value of the dependent variable EAT and interpreting the predicted results, <ul style="list-style-type: none"> - quantification and interpretation of the effects and impacts of the selected independent variables on the dependent variable, - determining the tightness of statistical dependence between variables using correlation analysis, - proposals and measures for increasing financial performance using the created model for the needs of financial management and prediction of trends in further innovative development of the analyzed cluster. 	<ul style="list-style-type: none"> - identification and selection of data needed to calculate indicators on the basis of economic profit, - analysis, selection and calculation of modern indicators (EVA) in the examined time intervals and periods, - sectoral comparison with organizations in the same sector on the basis of appropriately selected criteria, - analysis of value generators and interpretation of critical values of success, - determination of the dependent variable (EVA indicator) and independent variables (sales, costs, level 3 liquidity, net working capital, total indebtedness and GDP for industrial production in the cluster network), - compilation of a multiple linear regressions function using a software solution and a description of the individual relationships between the selected variables, - regression modelling with the aim of predicting the future development of the value of the dependent variable EVA and interpreting the predicted results, - quantification and interpretation of the effects and impacts of the selected independent variables on the dependent variable, - determining the tightness of statistical dependence between variables using correlation analysis, - proposals of measures to ensure an increase in financial performance using the created model and to predict trends for further development of the analyzed cluster with an emphasis on value management.

Figure 1 contains a specific proposal for an integrated model for evaluating financial performance and economic efficiency, prepared and based on an information source for the needs of financial management of member companies and clusters themselves, operating mainly as SMEs.

The actual design of the model, developed and applied in the current concept of clustering, consists in comparison and coherence of both known efficiency evaluation models, namely VSMFR model and VMMFR model, while the selection and determination of independent and dependent variables accumulate in a common database of variables and their calculation.

On the basis of economic profit and thus integrated regression functions are compiled, this sets up addressable regression modelling for already examined indicators from pre-selected indicators and performs quantification and interpretation of influences and impacts of selected variables.

In practice, this is a relatively complicated calculation, and in the case of the EVA indicator, many companies and clusters are not even able to complete the necessary data in practice. [1, 3]. The existence of various national or transnational empirical databases will help here, while it should be taken in consideration that if an organization wants to be successful, it is no longer enough to be profitable and satisfied with standard calculation methodology, but to ensure competitiveness and economic and product.

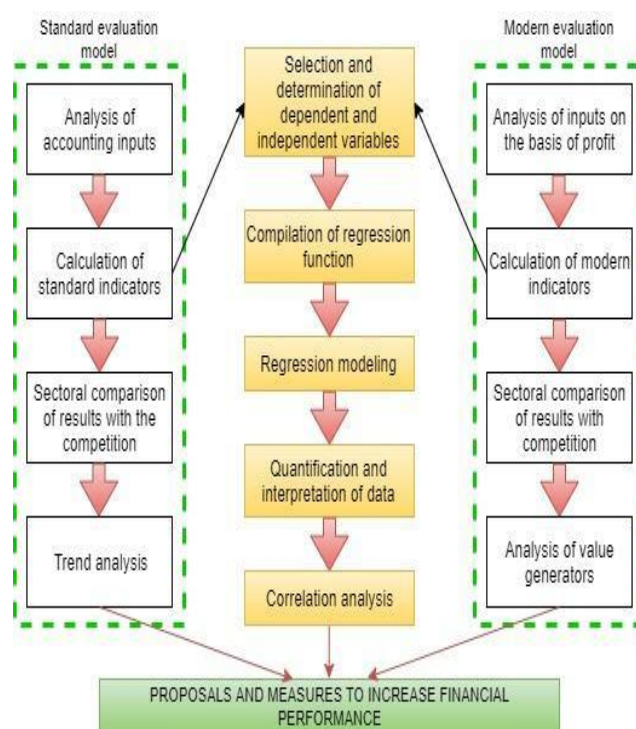


Figure 1: Proposal of an integrated model for evaluating the financial performance and efficiency of a cluster organization [authors]

The left side of Figure 1 shows in the model those standard evaluation tools within the VSMFR method, which are commonly implemented in management by economic managers, and on the right side newly conceived modern evaluation tools VMMFR, which the authors consider in

their proposals in research for clusters. It is clear that proposals and measures to increase the financial performance of clusters are the product of system elements (described in the middle of the figure) that seamlessly follows the evaluation process, and to implement a modern approach, cluster authors prefer analytical tools from the VMMFR model.

5. Diagnosis of economic efficiency and financial performance of clusters

In order to perform a clear and effective diagnosis of economic efficiency and financial performance, it is necessary to ensure the calculations of individual indicators and measured values from the economic data of the examined cluster for dependent and independent variables in the conditions of clusters. At the same time, the diagnostics are performed for an individual selected examined cumulative subject. This is a calculation of the main indicators (formulas) - Calculation [10] of cluster performance:

$$\text{spread} = \text{ROE} - r_e$$

Where: ROE – return on equity (ROE > 0 applies to a successful company),

r_e – cost of equity

Given that mainly selected SMEs within clusters mostly have a mixed capital structure and use foreign sources on an ongoing basis, the EVA (economic value added) indicator must be calculated according to the procedure:

$$\text{EVA} = \left[\frac{\text{EBIT} \times (1 - \text{tr})}{(E + D)} - \text{WACC} \right] \times (E + D)$$

and then

$$\text{EVA} = \text{NOPAT} - \text{WACC} \times C$$

$$\text{EVA} = \text{EBIT} \times (1 - \text{tr}) - \text{WACC} \times C$$

Where: NOPAT – cost of equity (input indicator that is related to extraordinary and accidental events)

WACC – weighted average cost of capital

EVA as an indicator is an expression of the short-term performance of the cluster and as a long-term indicator must be in perpetuity and therefore it is necessary to adjust the calculation with a discount, namely:

$$\text{NPV} = \frac{\text{EVA}}{r_e} = \frac{\check{Z}}{r_e}$$

The application of the present value of growth opportunities - PVGO, i.e. the part of the profit that can be invested in the growth and development of the cluster, is also incorporated into the calculation.

$$\text{NPV} = \text{MVA} = \frac{\text{EVA}}{r_e} + \text{PVGO}$$

To calculate the WACC, specialists Brealey, Myers, Allen [2]. apply the equation where the cost of debt after tax is used, which takes into account the already very objective tax compensation:

$$\text{WACC} = r_d \times (1 - \text{tr}) \times \frac{D}{C} + r_e \times \frac{E}{C}$$

In the next procedure, it is necessary to calculate the weights of individual capital items, the cost of debt and the cost of equity, using the formulas:

$$\frac{E}{C} + \frac{D}{C} = 1 \quad r_e = r_f + \beta \times (r_m - r_f)$$

where: r_d - cost of foreign capital

In their calculation methodologies, several authors emphasize that the EVA indicator can also be hierarchically des aggregated so that it is possible to identify the very quantities that affect it in practice.

NOPAT		EVA				Capital Cost	
EBIT	$\times (1 - \text{tr})$	Capital		\times	WACC		
Operating revenues	Operating costs	Own capital	Foreign capital	Cost of equity	Cost of foreign capital		

Based on previous calculations, the calculation of INEVA - IN added economic value is subsequently applied in the form of determining the spread coefficient (for long-term time horizon of cluster performance, which does not work with market prices of shares and shares of the cluster, which is an advantage in ensuring objectivity and eliminating data distortion, or the cluster itself), according to the formula [7]:

$$\text{INEVA} = \frac{(E - \text{PVGO})}{r_e} \times \left[\text{ROE} \times \left(\frac{1 + \text{PVGO}}{1 - \text{PVGO}} \right) - r_e \right]$$

After completing the calculation of the cumulative INEVA indicator, it is also necessary to determine the market value added of MVA. It is an indicator based on market performance and is very sensitive to changes and developments in the market.

The essence is that if the total market value of the cluster is greater than the capital that has been invested in the company, the cluster increases its value for its owners and management. The market value can be determined as the present value of future EVA according to the formula:

$$\text{MVA} = \text{PV}(\text{EVA}) = \sum_t^T \text{EVA}_t \times \frac{1}{(1+i)^t} \sum_t^T \text{EVA}_t \times (1+i)^{-t}$$

After all calculations have been performed, a correlation analysis must be performed to quantify the dependencies and analyze the effects [4, 10] of the main operating factors in the relevant market, using a calculation format of the type:

$$\tau_b = \frac{P - Q}{\sqrt{(P + Q + T_A) \times (P + Q + T_B)}}$$

Where: P – number of pairs of observations/ measurements (X_{ij} , $X_{i'j'}$), for which the following applies: $i < i'$ and $j < j'$ (these are so-called concordant consensual pairs);

Q – number of pairs $(X_{ij}, X_{i'j'})$, for which $i < i'$ a $j < j'$ (discordant, mismatched pairs);

TA – the number of observation pairs $(X_{ij}, X_{i'j'})$ for which $i = i'$, that is, pairs having the same variation of A characters (paired according to character A);

TB – the number of pairs of observations $(X_{ij}, X_{i'j'})$ for which $j = j'$, so that pairs that have the same variation of B characters (pairs connected by B).

Note: The coefficient τ_b ranges from -1 to +1 and the achieved values have the same meaning as the correlation coefficient. If there is a match between the variables, then the coefficient is = 1, otherwise the value is = 0 and if the opposite match is achieved between the examined variables, then the value of the coefficient is = -1.

6. Conclusions

The author team is convinced that this tool will be an important qualitative tool supporting managers in their daily activities. This concept is suitable for the development of tools enabling planning, modelling and diagnostics. Tools developed on the basis of the proposed concept, as envisaged by its principles themselves, will not be specialized in individual functional areas. The advantage of the concept is a large degree of openness, which allows the tools to build modularly - to extend the architecture with the new layers of models, to supplement them with new content processing mechanisms, universal or specialized libraries. Although the presented proposal of an integrated model of financial performance evaluation and the related methodology of monitoring economic and organizational effects recommends and justifies the suitability of a certain configuration of mathematical models, it does not limit its extension in any way. By adhering to the established principles, it makes it possible to acquire new features and functions of management tools based on the presented concept. The presented contribution of the authors is part of the results of the grant project NFP313020ANX5, financed from ESIF funds by the Ministry of Economy of the Slovak Republic entitled: "Design and development of integrated innovation infrastructure and knowledge base in the European area of the cluster organization NEK", research task no. 1.1: "Creation of a common expert database and analysis of the energy and environmental environment in the EU, Slovakia and V4 countries"

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THE READINESS REVIEW AND FUTURE ADJUSTMENTS OF SMART MANUFACTURING INDUSTRY IN THE SLOVAK REPUBLIC IN THE CONTEXT OF INDUSTRY 4.0

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Abstract: Emerging technologies such as the Internet of Things, artificial intelligence, robotics and additive manufacturing are predicted to bring profound impacts to production, transforming manufacturing from traditional industry to smart manufacturing in the Fourth Industrial Revolution. The digitalisation and automation of production bring positive economic impacts involving increases of productivity, quality and product customisation. On the other side, side-effect of labour-saving technologies like automation and robotisation can cause unemployment and inequality. As the speed and scale of change from those technologies are getting higher, there will be new risks of reshoring and de-industrialisation for countries that will not be ready for Industry 4.0 in the future. This paper aims to provide an overview of manufacturing industry in Slovakia from the post-socialist transformation period in 1990s until today, and to analyse its readiness for Industry 4.0. Manufacturing industry has been an engine of the economic growth and still an important pillar of the Slovak economy today. Therefore, the successful achievements from the economic transformation in the past may face unprecedented challenges that are being brought by new emerging technologies. In addition, the paper discusses some potential adjustments that should be introduced to develop the strong smart manufacturing industry, and to help the country stay competitive in the global market.

Keywords: Industry 4.0, emerging technologies, smart manufacturing, economic growth, industrialisation.

1. Introduction

Over the past several decades, new innovative technologies such as Artificial Intelligence (AI) and robotics, additive manufacturing (3D-printing), Internet of Things (IoT), Cyber-physical systems (CPS) have been advancing rapidly. For example, AI applications have overcome many challenges that were considered impossible in few decades ago. Nowadays, AI systems powered by machine learning algorithms with artificial neural network can train themselves, reaching beyond human intelligence capability in many fields such as gameplay (Board game Go) or AI-powered system for cancer diagnosis trained by billions of medical images. Emerging technologies with their disruptive factors have brought the new techniques for production in new business models that have not been seen before.

Recently, the convergence of emerging technologies in term of both speed and scale in the new digitalisation and automation era called Industry 4.0 has been transforming the traditional manufacturing industry into the new smart production. The digitalisation and automation of manufacturing enable companies to increase industrial productivity, to boost their efficiency of operational activities, as well as to reduce operating cost, to improve asset utilisation and to avoid downtime.

Manufacturing industry has traditionally been an engine for economic growth in many countries. Many advanced economies today such as the United States, the United Kingdom, Germany, Japan, France successfully captured that engine to modernise their economy during the very early industrialisation period. Today, manufacturing is the main factor of investment in research, development and

innovation, contributing more than 85% by the private sector in Germany, Japan [1]. The success stories have been seen from the Asian newly industrialized economies (NIEs) such as South Korea, Taiwan, Singapore and Hong Kong, to the recent successful cases of Central and Eastern Europe (CEE) countries including the Slovak Republic.

Besides the breakthrough benefits that emerging technologies have brought in, some negative impacts have also appeared in Industry 4.0. As labour-saving technologies are making countries possessing low cost advantages in manufacturing become less competitive, newly industrialised countries will be facing the new risks of de-industrialisation and mass unemployment in the future if they will not be ready for Industry 4.0.

The objective of this paper is to provide an analysis of manufacturing industry in Slovakia in the new trends of smart production within the context of the Fourth Industrial Revolution. Furthermore, the paper discusses some possible adjustments that will help to overcome potential challenges.

2. Literature review and major concepts

Technological advances have been playing the role of key drivers to increase industrial productivity since the early time of the industrial revolution. In the mid-eighteenth century of the first industrial revolution, the water and steam engine provided power to run factories. Electrification followed to shift industry to mass production in the early twentieth century of the second industrial revolution. From the beginning of 1970s, industry became automated with the new strength of

digital computing, the advances of information technology and mobile communications.

Recently, breakthrough technologies have been accelerating and transforming businesses to a new level in a new digital era. These profound changes have brought disruptive impacts to many industries in a new industrial revolution called the Fourth Industrial Revolution. Many leading industrial countries have been developing their national initiatives from the very early time to support their industry to stay competitive.

According to Lorenz et al. [2] and Schwab [3], key technological components of Industry 4.0 involve the Internet of Things (IoT), Artificial Intelligence (AI) and robotics, additive manufacturing (or 3D printing), Virtual and Augmented Reality (VR/AR), big data analytics, Blockchain, Cloud computing, and advanced materials.

Emerging technologies as the key components of Industry 4.0 are not working in isolation, but in the combination with others to maximise the business outcomes. The large amount of data generated from IoT devices will definitely need AI platforms to process with smart algorithms. AI systems are built with machine learning and big data analytics capability. The combination of IoT with AI will create various applications that can be applied in many industries, bringing many impacts there. The other technologies such as blockchain, 3D printing, AR/VR will amplify those impacts by adding several specific features into the real implementations.

As the increasing adoption of emerging technologies has been accelerating, this is transforming the manufacturing process. The new beneficial factors brought by emerging technologies can be summarised as follows.

AI and robotics as a new virtual workforce:

The adoption of AI and robotics solutions in manufacturing industry boosts the productivity of businesses significantly, reducing human errors and improving product quality. According to the research for 12 developed countries by Purdy and Daugherty [4], AI and robotics have the potential to increase labour productivity by up to 40% in 2035.

Boosting productivity and efficiency:

New emerging technologies have increased labour effectiveness and boosted productivity. For example, AI and robotics systems by coexisting in working with labour forces to enhance their natural intelligence capability can effectively contribute to increase productivity. Nowadays, AI and robotics are designed to handle complex tasks at scales beyond human capability. For instance, AI systems such as virtual assistant applications powered by cognitive computing and language processing are able to review 1,000 legal documents in a matter of days instead of taking three people to complete that task in six months [5].

Besides that, AI and robotics systems are designed to deal with hazardous tasks in the oil and gas industry and in exploration missions.

Improving asset utilization and reducing operating cost:

As IoT sensors can actively monitor machines in production lines with the support of Cloud computing to create new concept of “Digital Twins”, they help to detect potential issues by sending alerts to technicians, suggesting when machineries need repair. The mechanism of self-diagnose processes powered by AI bring a new capability to manufacturing called predictive maintenance. This reduces the downtime of machines, therefore reduces the operating cost and improves the asset utilization.

As emerging technologies have brought new fundamental factors for production transformation, countries without effectively applying the new technologies of Industry 4.0 may suffer from losing their international competitiveness.

3. A review of industrialisation in Slovakia

Since the decline of the Soviet empire since 1990, Slovakia started the economic transition together with other Central and Eastern Europe (CEE) countries. The result of the transformation of Slovakia's economy after three decades shows a significant shift from a centralised communist economic system towards a market economy. In 2019, the income per capita in Slovakia has reached 36,092\$, respectively, an equivalent of 72 percent of the average level of EU-28. This positive outcome of the transition is a result from a significant GDP per capita growth from a lower level of 14,584\$ in 1990 [6, 7].

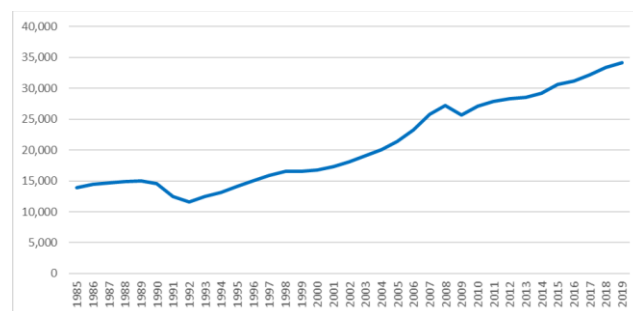


Figure 1: GDP per capita in the Slovak Republic from 1985 – 2019

Source: Author's calculation based on the Total Economy Database of the Conference Board

The Figure 1 shows that the development of GDP per capita has been through different periods with different levels of growth and fluctuation.

According to OECD Economic Surveys [7], in the recent years, the Slovak economy is in a phase of strong, broad-based expansion supported by internal and European demand while the country has been catching up with higher-income European countries.

In an overall view, the whole economic reform shows a difficult path towards the free market economy. The major achievements are the success in building up open market economy to successfully integrate with the European and the global economy; the attractive destination of FDI inflows and the improvement of the local business conditions; and finally, the increase in productivity, the average income and the standards of living.

During the economic transition, manufacturing industry has played an important role to attract large foreign investment inflows. This has helped Slovakia to develop a competitive export-oriented manufacturing industry. The Figure 2 shows the value-added manufacturing industry over periods from 1990.

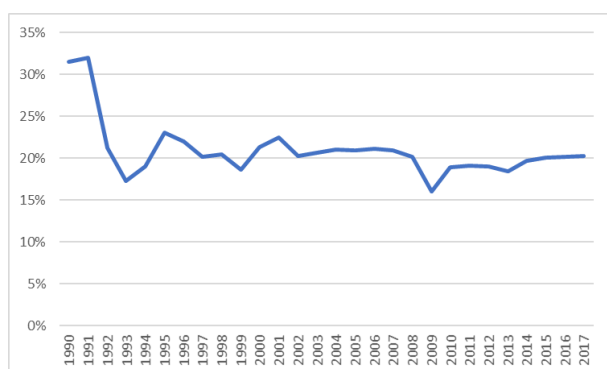


Figure 2: Value added in manufacturing industry – percentage of GDP from 1990 – 2017

Source: Author's calculation based on United Nations Industrial Development Organization

The industrialisation development in Slovakia has shown that the country has become mainly industrialised in the second half of the 20th century. Due to some historically strategic reasons, Slovakia built up its heavy industry including coal mining, steel and machinery production when CEE countries were part of the Soviet Bloc from 1945 till 1989. This heavy industry had occupied up to 49% of GDP with the dominance of the dogmatic central planning model before the post-socialist period started [6]. After 1990, the decline of the heavy industry followed by the growth of main industries such as automotive, electronics, engineering industries and Information and Communications Technology (ICT). These new industries have successfully leveraged the traditional and highly skilled labour force and its cost competitive advantage for their growth.

Among the key sectors in the manufacturing area, the automotive industry has the biggest share with the contribution of 27% of the total national export [7]. This sector is the fastest growing industry in Slovakia because of the large investments from Volkswagen, Peugeot, KIA Motors, and Jaguar Land Rover. In 2018, passenger production in Slovakia reached 1,031,241 units, making Slovakia one of the largest automobile producers in cars per capita [8]. The share of direct automotive employment

in total manufacturing in Slovakia is 15.4%, the highest ratio in all European countries with the average share of 8.5%.

Besides automotive industry, other industries such as mechanical engineering, chemical engineering and pharmaceutical industry are representing the key pillars of the economy. Engineering industries supported by strong historical background are helping to maintain the stability of the Slovak economy through keeping overall employment and potential job creation. New dynamic sectors of ICT and Shared Services have recently become important factors of the Slovak economy. Many high-tech businesses from both global players such as IBM, Dell, Siemens etc. and domestic Slovak IT companies (ESET, Sygic etc.) have been contributing to boost the growth of ICT industry. According to Statistical Office of the Slovak Republic, in 2019, ICT sector generated 7.3 billion EUR with the total employment of 62,533. As the productivity increase from ICT sector is high, and the gross value added to the economy is higher than any traditional sectors such as agriculture or financial and insurance services, this sector is considered one of the potential sources of long-term economic growth.

4. Slovak manufacturing in the context of Industry 4.0

As the previous section shows that emerging technologies are bringing disruptive factors that will fundamentally transform the future production, this section will analyse the current economic landscape of Slovakia and identify some key reasons why Slovakia needs to be ready for Industry 4.0.

Slovakia has successfully integrated into global value chains with the role of an EU member after the post-socialist transformation period. The successes in economic growth, in increasing labour productivity and improving standards of living are undeniable. However, as we have seen a decline of FDI flows and a slowdown of economic convergence in the last decade, this raises a question of how Slovakia should do to overcome several critical weaknesses exposed recently in order to keep the positive economic gains from declining in the future in the new context of the Fourth Industrial Revolution.

According to Nedelkoska and Quintini [9], 33% of all current jobs in Slovakia are at highly risk of automation. This percentage is very high while this is only 6% in the case of the jobs in Norway.

The risk of job automation links to the high labour share in manufacturing employment, 24.7% of the total working population in 2018 which is a quite high ratio compared with other European countries. The automotive sector, the biggest manufacturing sector contributing half of total industrial production in Slovakia, is a leader in implementing robotic devices. According to International Federation of Robotics, companies installed 169 robots per 10,000 workers in 2019, a big jump from 79 robots per

10,000 workers in 2015, making Slovakia the 17th largest robot market in the world.

While the trend of robot implementation in traditional automotive manufacturing is going on, the second transition from combustion to electricity in the automotive industry is expected to bring more profound changes in businesses such as production model, supplier network, and labour force. Currently, most cars produced in Slovakia have equipped with combustion engines. The impact to the industry will be huge because electric cars are much simpler and fewer components are needed. Therefore, the supplier network will be simpler and smaller too, with higher requirements of digitalisation and automation.

Besides the installation of robots in the FDI-owned car manufacturers, their suppliers are also introducing more robots into their manufacturing processes. Other industry sectors such as metal industry and electrical engineering sector are managing to increase their implementation of robots too. The speed of robot implementation will help industry firms stay competitive in Industry 4.0 when the local labour forces are under the unprecedented threat of losing their jobs, especially for routine or low-skilled jobs. This trend may generate some new jobs, but those new jobs will require high skills or certain job types that may not be fitting for current employees.

As analysed in previous section, Slovakia is facing the major challenges like other countries in Industry 4.0. Firstly, Slovakia may lose its competitiveness due to new labour-saving technologies. Secondly, Slovakia as a typical manufacturing-led and export-oriented country, it has the traditional model of large production runs using low value-added downstream activities in labour-intensive segments [6], therefore, Slovakia will be exposed to the future threat of back-shoring and will be facing difficulties to attract new FDI inflows. Finally, wages have been growing fast in Slovakia, especially for highly skilled workers. As the labour market is rather tight, recently foreign investor have asked for more immigration to supply more skilled workers. According to the report of OECD Economic Surveys for Slovak Republic in 2019, the current economic success with value added contribution for exports is narrowing to a few industries. The spillovers have not seen much in many other small and local owned companies. This is the reason why productivity in other sectors in Slovakia is falling further behind international level.

Readiness assessment result for the Future of Production Report 2018 [10] shows the overall benchmark of the Slovak Republic is in the Legacy area. According to the authors, Slovakia as one of Legacy countries currently has a strong Structure of Production, however, displays a low level of readiness for the future of production, characterized by weak performance across the Drivers of Production. Therefore, Slovakia is in the urgent need to be

ready for the Fourth Industrial Revolution to keep its position in the global competition.

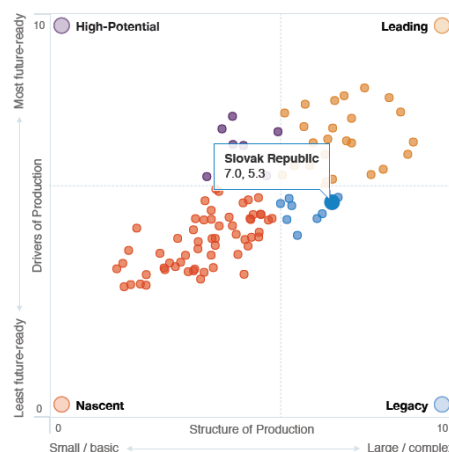


Figure 3: Slovakia's benchmark for Readiness for the Future of Production 2018

Source: Readiness for the Future of Production Report 2018 [10]

Currently, Slovakia has a national policy initiative called Smart Industry Platform. This is a platform for industry – government interaction with the focus on technology adoption, R&D collaboration, education and skill development, and raising awareness of smart manufacturing.

The analysis in the previous section shows that there is an unbalanced issue in the social-economic structure in Slovakia. The country needs to start the diversification of the economy, not focusing mainly on car assembly industry with high level of labour-intensive factor and low added value. Automotive industry should still remain an important industrial pillar, however, the government should introduce policies to attract higher added-value productions, more R&D capacities, and more investments that support the trend of electric car production in the future. Besides that, new and young dynamic industry such as ICT recently has gained higher attention because of its high added value. Currently, ICT sector contributes 4.6% to Slovakia's GDP and has significant potential for growth in the future. Hudec and Sebova [11] analyse an interesting case of how Kosice area - an eastern economic region in Slovakia has been transforming itself from an underdeveloped region with old legacy of heavy industry, facing serious regional brain drain towards a dynamic knowledge base area. In a nation-wide level, Slovakia should focus on many dynamic sectors like ICT to make it an innovative country with more open policies and institution changes.

In addition to that, more service sectors in the economy should be strengthen in order to make the economic structure more balanced. According to Gorzelak et al. [12], during the recession and de-industrialisation in the past, service sectors have played as supplement role to keep the

economy from entering into deep recession and to maintain their momentum throughout the last many decades until today.

Among other factors, education plays a crucial role to determine how strong of the Slovakia's workforce will be in the future. This requires changes such as investments to crease quality of educational sector, to tackle current fundamental problems in education related to innovation, research and collaboration with businesses and industries. Sucha [13] proposes to improve higher education as well as vocational training, to invest in professional lifelong learning in order to re-skill or upskill people to prepare for the readiness of the workforce.

Finally, Slovakia also needs to boost the regional cooperation. International cooperation with European strategic R&D programs such as Horizon 2020 should be improved in order to bring more benefits to Slovakia. Besides that, as sophisticated technologies will be used in globally connected production systems, regulations and legal frameworks for emerging technologies need to be adopted to make sure that the country will be ready for the full compliance with new standards, norms and interoperability in Industry 4.0.

5. Conclusions

In the near future, emerging technologies as key technological components of Industry 4.0 are expected to bring profound impacts to manufacturing industry. The digitalisation and automation of production bring positive economic impacts such as increases of productivity, quality, and enhancing the flexibility and customization. In addition, new business models are expected to be generated more to boost the economic growth. On the other side, there are many challenges coming together such as losing jobs by automation and robotisation, inequality, and job polarisation in labour market.

Slovakia has successfully developed the economy after the post-socialist transformation period from 1990s. Manufacturing industry has been shown as one of the engines for economic growth for the country until today.

However, with the disruptive impacts of new emerging technologies such as high level of production automation, large labour-saving, production on demand and product customization in smart manufacturing, the new risks of reshoring and the trend of de-industrialisation will be inevitable in the near future.

Therefore, Slovakia needs to introduce structural changes to expand more value added sectors such as ICT area and service sectors to diversify the economy; and reform of the education systems to make fundamental changes to upskill the workforce and to tackle several current issues such as lack of innovation and collaboration, and brain drain problem. In addition, the country needs to boost the regional cooperation to make sure that regulations and

legal frameworks for new emerging technologies will be ready for the full compliance in Industry 4.0.

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BEHAVIORAL FINANCE IN THE EUROPEAN CAPITAL MARKETS: AN EVIDENCE THROUGH ETHNOGRAPHY AND SEMI-STRUCTURED INTERVIEWS OF EUROPEAN PORTFOLIO MANAGERS

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Abstract: In contrast to the conventional academic finance theories - like the Modern Portfolio Theory and the Efficient Market Hypothesis - Behavioral Finance endeavors to bridge the gap between finance and psychology. Behavioral Finance analyses the cognitive factors and emotional issues that impact the decision-making process of investors and consequently, the investment performance. The decision-making by individual investors is usually based on their age, education, income, AUM and other demographic factors. The impact of behavioral aspects of investing, however, often are ignored. This paper seeks to find the influence of certain identified behavioral finance concepts. In order to explore how emotions, cognitive errors and behavioral factors affect the investment decisions, semi-structured interviews with European Portfolio Managers were conducted along with ethnographic observations. The results provided an evidence for the existence of behavioral factors at the European stock exchange. The results showed that the behavioral biases affect even the decision-making process of professional investors. The results may be used for better decision-making for investors. The results of this papers are important for portfolio managers, brokers and investors. They can relate the findings of this study while making more rational investment decisions.

Keywords: Behavior Finance, Behavioral Factors, Investment Decisions, Ethnography

1. Introduction

Finance can be broadly described as the art and science of decision-making involving money in various contexts. Finance is studied so that human is able to allocate their limited resources over time in times of uncertainty. Within the traditional theory of finance, there are two crucial aspects: First, perfectly rational behavior of market agents. A rational investor is the one who always (i) updates his beliefs, if there are any new pieces of information; (ii) makes normatively acceptable decisions. [1] Second, existence of Efficient Markets. Assumption of EMH that all the significant details are shown in stock market prices wholly and instantaneously. When this assumption holds true, the prices are correct, and opportunity for excess returns does not exist. Since the emergence of EMH, lot of emphasis has been put on multiple advanced asset pricing models, their testing and development. [2]

A study conducted by Subrahmanyam (2007) groups main paradigms of finance: i) Portfolio allocation is determined by expected risk and return; ii) Asset pricing models based on risk; iii) The pricing of contingent claims; iv) The theory of Modigliani-Miller and its advancements by agency theory. [3]

There is a critical assumption about wealth and value of people that they act rationally while deciding on any financial aspect. Although the models remodeled the field of research in finance, the theories still have not answered many gaps. For instance, what is investors motive behind trade, and other than risk, what are the reasons for fluctuation in returns of a stock?

Psychological researchers have found irrational manner in investors behavior when it comes to deciding on economic decisions. Especially if money is involved, then people often behave in unusual and odd ways during the decision-making process. The reason behind that is that cognitive errors as well as extreme emotions can let investors making a bad - irrational - investment decision.

2. Behavioral Finance and Literature Review

Behavioral finance is relatively a recent approach which focuses on combining behavioral and cognitive psychological theory with traditional finance and economics. Its goal is to explain why market participants make improvable or wrong and, therefore, irrational financial decisions. [4] Consequently, psychology, sociology and finance form together the framework of behavioral finance as shown in Figure 1.

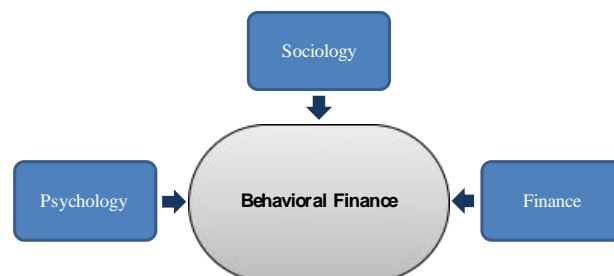


Figure 1: Concept of behavioral finance
Source: authors construction

Behavioral economics was officially founded by Daniel Kahneman and Amos Tversky in 1979 with their work on prospect theory and how individuals approach economic risk, even though economists have been studying financial

behavior for centuries. [5] Based on their work, Richard Thaler started working in this field and authored various books and papers and has become one of the most famous name in the field. [6]

In the opinion of Nofsinger (2001), behavioral finance, studies the behavior of market participants in actual financial settings. It is the branch of finance which specifically examines the effect of psychology in financial decisions, in corporations and financial markets. [4]

In the view of Barberis & Thaler (2005), behavioral finance argues that the deviations from the fundamental value of a stock are caused by the presence of traders who are not entirely rational. There are strategies to correct those mispricing, but they are too costly and risky. Therefore, the mispricing remains. [7]

According to Sewell (2007) behavioral finance studies the impact of psychology on the behavior of investors and the consequent effects of investor's decisions on financial markets. when investors make decisions guided by emotions or intuitions, this describes exactly what behavioral finance studies. [8]

Shefrin (2000) identifies the theory of behavioral finance as a field of study which deals with the impact of psychology on the behavior of market participants. [9]

In general, it can be seen that individual and institutional investors differ in terms of both size and characteristics and therefore differ quite significantly in terms of the impact on behavior. Moreover, institutional and individual investors vary in their risk attitudes, time range and profit purposes.

Other researchers, such as Fisher & Statman (2002), argued that institutional investors are affected by behavioral biases in the same way as retail investors and that these biases influence both investor groups equally. [10]

However, institutional investors are assumed to behave rationally as they invest more effort and time in their investment decisions and are able to make more adequate investment decisions through faster learning. [11]

Given these facts, it seems impossible to claim that institutional investors behave in a fully rational way. The aim of this study is therefore to analyze the factors that influence the decision-making of Portfolio Managers and to fill some important gaps in the field of behavioral finance in Europe.

3. Theoretical basis and methodology

To get a detailed understanding of behavioral factors that influence the investment decision-making style of European Portfolio Managers, qualitative research strategy was used. As Cooper & Schindler (2012) already highlight, the reason for adopting qualitative research

strategy is to collect data that portray an accurate picture of events, situations and interactions with people & things. [12] So in this study, an ethnography and semi-structured interview method is used to collect data from European Portfolio Managers. Using an ethnographic approach, a deeper understanding of the perception of European Portfolio Managers is provided through direct observations. For instance, Siggelkow (2007) describes ethnography as a robust tool to build a theory. [13] As professional investors involved in daily share price movements, they can better explain what behavioral aspects influence the decision-making into the European stock market. The most commonly used method for gathering information is doing an interview. The structure of interviews can vary from highly structured to unstructured interviews. To achieve the purpose of this thesis, a semi-structured interview is used to discover the impact of behavioral factors on the decision-making of European Portfolio Managers. Using a semi-structured interview, which is more flexible and comparable, can help the interviewer to concentrate on the main objective of the interview. [14]

4. Descriptive results of the semi-Structured interviews

The semi-structured interviews were conducted in 9th of March 2021 and in 7th of April 2021 virtually via Video-Call software like Microsoft Teams or Zoom. In total, nine experts were interviewed by the author of this thesis. European Portfolio Managers were directly contacted by the author with the help of three directories of membership: fondsweb.com from FWW Media GmbH as well Bloomberg, where every mutual fund is listed. The average age of the experts – which were interviewed by the author – is 55 years and the average work experience is 26 years, so these experts have spent most of their time at stock exchange. The average asset under management is € 5.136 Million. That said, it is important to mentioned two outsiders, one above € 38 Billion and the other € 15 Million. Therefore, the median is a better measurement, and the median is € 375 Million of that sample. Table 1 contains the list of interviewees and shows the education, age, working-experience as well the asset under management.

Table 1: List of semi-structured interviewees

No.	Name (Initials)	Education	Age	Work Experience	AUM in Mio. €
1	A.H.	PhD. in Economics	59	28	5.000
2	B.G.	Diploma in Business Administration	67	39	375
3	D.R.	Diploma in Economics	42	16	190
4	D.H.	PhD. in Finance	53	24	38.000
5	M.E.	PhD. in Economics	65	31	15
6	K.T.	Diploma in Economics	57	28	1.400
7	M.S.	Law Degree (LLB)	62	35	355

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EUROPEAN PORTFOLIO MANAGERS AND BEHAVIOURAL FINANCE: A STRUCTURAL EQUATION MODELING APPROACH

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Abstract: Behavioral science in the field of finance and investment is among new topics raised in recent years. In contrast to the conventional academic finance theories behavioral finance endeavors to bridge the gap between finance and psychology. Behavioral Finance analyses the cognitive factors and emotional issues that impact the decision-making process of investors and consequently, the investment performance. The main objective of this study is exploring the behavioral factors influencing professional European investors, namely Portfolio Managers. As there are limited studies about behavioral finance and their influence on European Portfolio Managers, this study is expected to contribute significantly to the development of this field. To achieve this objective in the European stock market, over 119 European Portfolio Managers were selected randomly. Data was collected by questionnaire according to experts, the validity and reliability by Cronbach approved, have been conducted to analyze the data by using the statistical software SPSS and AMOS. This research also attempts to determine the correlation between these behavioral factors and investment performance. Among the behavioral factors mentioned before, only five factors influence the investment performance of European Portfolio Managers: Price Anchoring, Availability, Mental Accounting, Overconfidence and Loss Aversion. Mental Accounting was found to have the most significant positive impact on investment performance, while Overconfidence and Loss Aversion had a more minor positive effect on investment performance. In contrast, Price Anchoring has a negative impact on the investment performance of European Portfolio Managers.

Keywords: Behavioral Finance, Behavioral Bias, Investment Decisions, Factor Analysis, SEM

1. Topicality and Actuality

The most conventional academic finance theories are referred to as traditional finance using models in which investors are rational and making rational decisions regarding a stock purchase or sale. If the traditional finance theories like the Modern Portfolio Theory (MPT) and the Efficient Market Hypothesis (EMH) really hold, how can than market anomalies, like the DotCom-Bubble, January-Effect, the Financial Crisis in 2008 or even the Bitcoin-Mania, be explained? [1]

Behavioral Finance endeavors to bridge the gap between finance and psychology analyses the factors which can impact the decision-making process of individuals. The topic of behavioral finance and the decision-making process of investors occurs already in the early 1980's, but is still highly relevant for the stock markets worldwide, even in at present. More recently, during the COVID-19 crisis some of the most volatile days on the stock market shocked the financial world. A lot of this can be connected to human emotion, since human decisions are based 80% of emotions. Accordingly, behavioral rules can be formulated to professionally stabilize one's own portfolio and perfectly position it for a market recovery, making behavioral finance more relevant than ever before.

The groundbreaking research of psychologists Daniel Kahneman and Amos Tversky in the early 1980s, and the psychological research that has built on it over the last nearly four decades, have revealed astonishing insights into the intricate workings of the human mind. Behavioral

finance research has uncovered widespread, deeply rooted, unconscious biases and heuristics in human decision-making and opened up a whole new perspective on why we behave the way we do. These insights originated in psychology but are highly relevant to the world of finance that Kahneman was awarded the Nobel Prize in Economics. Together with the most recent Nobel Prize winners Robert Shiller (in 2013) and Richard Thaler (in 2017), a total of now six Nobel Prizes for behavioral science have now been given. The resulting work represents an entirely new field of work called behavioral finance and underlines the importance of behavioral finance in the past but even more so in the future.

In general, individual and institutional investors differ in terms of both size and characteristics and therefore differ quite significantly in terms of the impact on behavior. Moreover, institutional and individual investors vary in their risk attitudes, time range and profit purposes.[2] Other researchers, such as Fisher & Statman (2002), argued that institutional investors are affected by behavioral biases in the same way as retail investors and that these biases influence both investor groups equally. [3] However, institutional investors are assumed to behave rationally as they invest more effort and time in their investment decisions and are able to make more adequate investment decisions through faster learning.

Given these facts, it seems impossible to claim that institutional investors behave in a fully rational way. The aim of this study is therefore to analyze the factors that

influence the decision-making and investment outcomes of Portfolio Managers and to fill some important gaps in the field of behavioral finance in Europe.

2. Data Process and Methodology

Data was processed and analyzed by using statistical software like SPSS and AMOS. Regarding the different data processes and methodologies, the methodology of the semi-structured interviews is explained first. After that, the main method with the data of the questionnaires is defined.

After collecting the questionnaire data, the first step is the cleaning of those data by excluding the questionnaire with poor quality, meaning incomplete questionnaires. Various statistical techniques were applied in order to attain the objective of the research. Statistical tools like descriptive statistics (mean, standard deviation), factor Analysis to identify the behavioral factors which influence investment performance, to test the reliability of the construct, Cronbach's alpha was used, and to analyze the impact of independent variables on dependent variables SEM was used.

To describe the personal information of the respondent, descriptive statistics were used. Descriptive Statistics summarizes the data at hand through these specific numbers to understand the data more accessible. Descriptive statistics represent the data which is available and not based on any probability theory.

In order to reduce the larger number of variables into fewer manageable factors, factor analysis is used. [4] Maximum common variance form all variables are extracted and then put them into a standard score. [5] It is part of the general linear model (GLM) with several linear relationships, no multicollinearity, and an accurate correlation between variables and factors. [6]

In factor analysis, the questionnaire variables are included in same group representing similar characteristics. Factor analysis can be classified into two main types: Exploratory factor analysis (EFA) and Confirmatory factor analysis (CFA). EFA is the basic factor analysis technique used by researchers when there is no previous literature available. Which factor/ indicator will belong to which factor, researcher has no prior knowledge. Moreover, it attempts to explore the basic framework of a relatively large number of variables. Whereas, factors and their factor loadings are determined using CFA. It confirms what is expected from the primary or re-established theory. It is expected that there is some connect between factors and subsets of variables measured. [7]

Factor analysis has been used in this work, to identify the factors that influence behavioral factors and performance of investors. To be precise, EFA is used to eliminate the items which are less important for the study and to retain the important factors

Certain criteria should be met in factor analysis regarding sample adequacy, sphericity, variance Eigen value etc. In this work, the criteria of EFA followed is shown below:

1. All the factors selected for CFA must have factor loading greater than 0.5. Factor loadings are the results of factor analysis which acts as a threshold for selection of factor and consequently eliminate less important factors which leads to data reduction. [8]
2. Another criteria which should be met is measure of sample adequacy. KMO test is applied to measure the sample adequacy. Kaiser- Meyer- Olkin is the test which represent the level of suitability of using EFA for selected sample. Ideally a sample should have KMO value between 0.5 to 1.0, this indicates that sample is good enough. [9]
3. Total Variance Explained can be understood as variance in dependent variable explained by all the factors in total. TVE is used to identify the number of retained factors. Ideally all the factors should explain at least 50% of the variance in dependent variable. [10]
4. In factor analysis, Eigenvalues are applied to condense the variance in a correlation matrix. Eigenvalue is the variance in all variables explained by one particular factor. Ideally Eigen value should be greater than 1, eigen value less than 1 means that factor is not able to describe the information equal to the information described by a single item of the variable. [11]

SPSS was used to undertake EFA with these different criteria.

In social science and behavioral research, reliability of the construct is identified by Cronbach's Alpha After applying factor analysis, major behavioral factors which influence investment performance of investors were identified. Then Cronbach's alpha test statistics were calculated for selected factors. Research highlighted that a value of Cronbach's alpha equal to or greater than 0.7 is considered good enough to ensure the reliability of the construct. Cronbach's alpha was calculated using SPSS. [12]

SEM (Structural Equation Modelling) is a combination of Confirmatory factor analysis and regression. Structural equation modelling examines the causal relationship between the variables. Other than experimental and observational research, SEM is used in Behavioral science also. In this work, SEM was used to identify which behavioral factor influence the decision making of the investors in European Stock Exchange on the basis of their regression weights. SEM was applied on AMOS software. [13]

The summary of the data process and data analysis are displayed in the figure above. Starting with the semi-structured expert interviews and their findings to underpin the design of the questionnaires. After the data cleaning and the descriptive statistics, the EFA should be done.

Ending with the Cronbach's Alpha and finally end with the SEM to identify which behavioral factors have a significant influence on the decision-making process and consequently on the investment performance.

3. Factor Analysis and Cronbach's Alphas

The questions of the questionnaires were framed to examine the impact of behavioral variables on investment decisions of portfolio managers in European Stock Market. Whereas, the perceived investment performance is identified from question code IP3.

Table 1: Questions about the behavioral factors

Behavioral Factor	Explanation	Questions code
Overconfidence:	Experienced investor, confidence in own ability to outperform, stock trades, knowledge to outperform and point market reversals	OC
Loss Aversion	Losing vs. gaining, nervous by losing and investment decision in poor market environment	LA
Herding	Following the trading actions of other investors, as buying and selling, choice of stock, volume of stock, and speed of Herding	HE
Representativeness	Investments depending on past earnings and stock performance, hot stocks vs. poor stocks	RE
Price Anchoring	Comparing current stock prices with their past prices and fundamentals, and buying price as a reference point	PA
Availability	Rely on friend or co-workers' opinions, information from the internet or company and believe in financial experts' opinion	AVA
Mental Accounting	Treatment of portfolio elements and their past performance	MA
Regret Aversion	Investment decision based on low risks, fundamentals, price movements or another investor's opinion	RA
Self-Control	Gender and investment type	SC

Source: authors construction

Factors were identified using exploratory factor analysis in SPSS. After eliminating several unsuitable items, whose factor loadings were less than 0,50, 6 factors were identified. Out of which 5 behavioral factors and 1 investment factor was identified. Eigen Value was 1.027 and the value of KMO was identified to be 0,815, (sig. = 0,000), 73% total variance was explained by these factors. Factor loading for all the variables were greater than 0,5, which makes the results acceptable and suitable for further analysis. The Following table shows the result of factor analysis done by SPSS.

Table 2: Factor analysis of behavioral variables

Factor	Factor Loadings						
	F 1	F 2	F 3	4	F 5	F 6	F 8
PA1	0,75						
PA4	0,64						
PA5	0,73						

PA6	0,85						
LA1		0,85					
LA2		0,62					
LA3		0,62					
LA4		0,80					
AVA3			0,82				
AVA4			0,81				
AVA5			0,69				
AVA6			0,64				
OC3				0,78			
OC5				0,83			
OC6				0,80			
MA1					0,88		
MA2					0,62		
MA3					0,63		
OC1						0,87	
OC2	0					0,77	
IP3							0,89

Source: authors construction

The reliability of the construct is very important aspect of data analysis, as if the reliability of instrument is compromised, no matter how robust the results are, we cannot be ascertain about their accuracy. This segment measures the reliability of the construct using Cronbach's Alpha:

Table 3: Summary of the Cronbach's Alpha

Factor	Variables	Cronbach's Alpha
Price Anchoring	PA1 PA4 PA5 PA6	0,9
Availability	AVA3 AVA4 AVA5 AVA6	0,8
Mental Accounting	MA1 MA2 MA3	0,8
Overconfidence	OC3 OC5 OC6 OC1 OC2	0,7
Loss Aversion	LA1 LA2 LA3 LA4	0,8

Source: authors construction

From the table, it is evident that all the factors are having alpha value greater than 0,6. These indexes show that items included in the factors Price Anchoring, Availability of Information, Ability of the Investor, Mental Accounting, Overconfidence and Loss Aversion are reliable enough for further analysis i.e., Structural Equation Modelling to identify the between those factors. Overconfidence has an alpha value of 0,7, which is very low, but still acceptable.

4. Results from Structured Equation Modelling

SEM (Structured Equation Modelling) is a technique which combines factor analysis and regression analysis into one model. The relationship between various variables of the study is identified by SEM. Confirmatory Factor Analysis (CFA) aids in identifying the factors which have a bearing on investment performance. Exploratory Factor

Analysis (EFA) provides the factors and CFA confirm the results and identifies which factors are suitable for further analysis. EFA was done SPSS, while AMOS is used to do CFA. Whereas Regression measures the magnitude of the impact of each variable, also known as regression weights. Another prominent aspect of SEM is model fitness. Which means SEM measures whether the presented model in the study is fit or not, is determined based on certain indices.

Table 4: Model Fit Measures for Model

Measure	Value
CMIN/DF	1,987
P Value	0,000
CFI	0,859
GFI	0,815
AGFI	0,753
SRMR	0,053
RMSEA	0,085
PCLOSE	0,000

Source: authors construction

The model fit is substantially good with GFI of 0,851 (Goodness- of- fit Index). CFI (Comparative- fit- index) is 0,859, RMSEA=0,085, CMIN/DF= 1,97, P Value= 0,000.

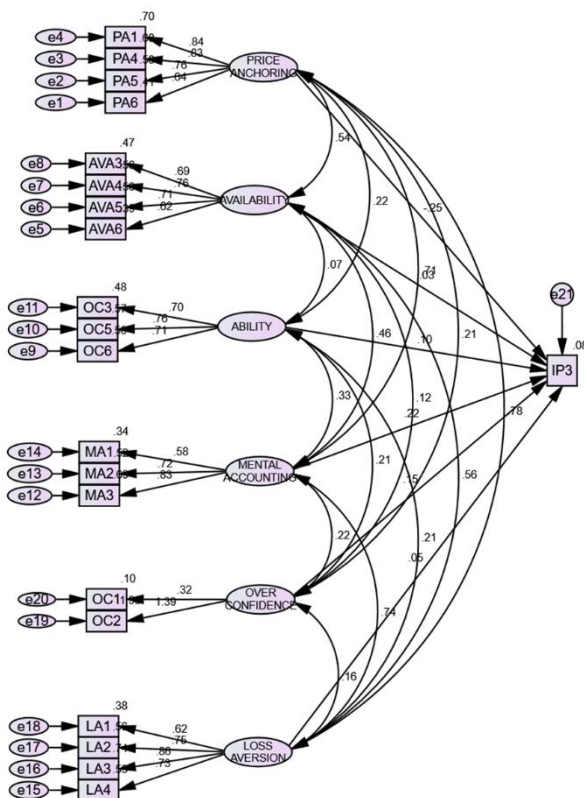


Figure 1: SEM for behavioral factors

The results show that convergent validity of data is ensured as each factor and its variable are having factor loadings more than 0,5. Mental Accounting is the factor which has highest impact on investment performance, having regression weight of 0,224. Availability of information has regression weight of 0,034 which slightly

influence investment performance. Overconfidence and Loss Aversion also have an impact on performance of investment. There regression weights are 0.150 and 0.048 respectively. One of the behavioral factors is having negative influence on investment performance, that is Price Anchoring, its regression weight is -0,240.

5. Conclusions

The findings of this paper propose that the behavioral factor of price anchoring is having negative impacts on the investment performance of the investors and hence should be handled with utmost care. The findings also suggests if we improve the herding and heuristic behavior of investors, their investment performance can also be improved. One of the astonishing findings of the study is that behavioral factors are reported to have high impact on investment decision making but they do not significantly influence the investment performance of the investors. Thus, the null hypothesis that all behavioral factors have a significant positive impact on investment performance of the investors is not supported by the results of Structured equation modelling (SEM). This study was conducted in European stock exchange, out of total 9 factors only and only five factors are expected to have a significant influence on investment performance of the investors.

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FUTURE OF SIMPLE JOINT STOCK COMPANY IN SLOVAKIA AND ITS PENAL AND ECONOMIC FEATURES

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Abstract: *The authors deal with the topics related to the simple joint stock company as a new form of the business company that can be founded in Slovakia. In the Slovak business area, the economic functioning of commercial companies is predominantly based on financing by foreign sources and the companies are not equipped with significant equity issues. Especially due to the development of science and technology and the related establishment of start-up companies in this area, the need for a new type of business company came to the fore. The authors analyze the pros and cons of newly enacted business form and try to evaluate its penal and economic features. Moreover, the authors discuss the future of simple joint stock company in Slovakia.*

Keywords: *joint stock company, start-up, economic and penal features, new business form*

1. Introduction

Lately, when choosing a capital trading company, entrepreneurs in the Slovak environment most often chose either a limited liability company or a joint stock company. Limited funding opportunities do not meet the rapidly changing needs of entrepreneurs in the market and in recent years it is possible to identify an increase in private investment (venture capital in the form of equity) in start-ups and project companies (so-called start-ups and scale-up), as well as obtaining foreign resources outside traditional banking sector. In accordance with Act no. 290/2016 Coll. on the support of small and medium-sized enterprises and on the amendment of Act no. 71/2013 Coll. on the provision of subsidies within the competence of the Ministry of Economy of the Slovak Republic, as amended, means a company compulsorily creating share capital, domiciled in the Slovak Republic, less than 36 months since its establishment and controlled by natural persons who are its founders. the company is an innovative enterprise, a micro enterprise, a small enterprise, or a medium-sized enterprise.

The intention was to create a type of company that would be more flexible for investors, less demanding on the initial financial resources for starting a business and at the same time would give start-up companies an advantageous legal form for them. Therefore, as of January 1 2017, we can choose the type of simple joint stock company when starting a business (and not only in the case of start-up companies). It can only be described as a "simple joint stock company". A simple joint stock company is a new type of capital trading company and was introduced into practice by an amendment to the Commercial Code based on Act no. 389/2015 Coll. amending the Commercial Code, as amended. A simple joint stock company was introduced into Slovak company law as a legal form with elements of a joint stock company and limited liability companies, with a high degree of disposition [1] of legislation allowing the creation of special types of shares issued by the company and internal organization of the

company flexibly according to the purpose of a simple company. The need to create such a new type of business company was based on the government's concept of support for start-ups and the development of a start-up ecosystem in the Slovak Republic. In the opinion of the legislator, for the purpose of this development, the partial incorporation of selected legal institutes into existing forms of companies would not be sufficient, and therefore the creation of a new form of business company was proposed. Such a solution can be accepted, as the opacity of the legislation and the appropriate reference to other institutes in other companies often lead to opacity and legal uncertainty. However, as we state below, even in the case of a simple joint stock company, only specific rules have been created for this company and for other issues not regulated there, the regulation of a joint stock company will be used as general legislation. Commercial Code in the part of a simple joint stock company regulates only the specifics and deviations from a joint stock company and therefore the simple joint stock company will be largely governed by the legislation of a joint stock company, which must be interpreted in accordance with the relevant special legislation of a simple joint stock company.

The aim of this regulation was to offer a comprehensive solution for risky investments in start-ups, support their development in the Slovak republic and introduce a new legal form of capital trading company, which would allow flexible setting of property relations within the company, investor in the company, entry and exit of the investor. . Another peculiarity of a simple joint stock company is the fact that the legal regulation allows shareholders to leave the company under specified conditions. In case of a joint-stock company, such a possibility comes into consideration only in exceptional situations, such as cases of merger or division of companies. In the case of joint stock company, whose shares have been admitted to trading on a regulated market[2], shareholders may withdraw from the company as part of the exercise of the legal institute called "sell out" [3].

2. Hybrid form of the company and its features

A simple joint stock company is a kind of "hybrid" form of a capital company, which includes certain elements of a limited liability company (low share capital, optional establishment of a supervisory board) and a joint stock company (share capital is divided into a number of shares with a certain nominal value, participation in the company is expressed by the ownership of shares as a security). A simple joint stock company is a private equity company. As with the establishment of a company, the public is excluded from this institute in the event of an increase in share capital. Last but not least, a simple joint stock company contains specific institutes which, compared to a joint stock company, allow for a more flexible setting of shareholder relations between shareholders and the issuance of specific types of shares that cannot be issued in a joint stock company.

Another positive aspect that the founders naturally take into account when choosing the legal form of a company is that a simple joint stock company has the lowest required share capital among capital companies, namely 1 euro. [4] However, the amount of share capital should correspond to the adequacy of the business objectives. In our opinion, the adequacy of business goals - ambition in relation to the amount of registered capital - is to provide the necessary capital for the successful start-up of a business company. A simple joint stock company as a private capital company has its specifics that, when it is established, it is necessary to repay the entire designated share capital. This fact conditions the creation of a simple joint stock company by registration in the Commercial Register.

The law does not explicitly limit the establishment of a simple joint stock company to shares only for "start-up" purposes and it is therefore possible to establish it for the purpose of any business plan. However, a simple stock company cannot be established for any purpose other than business. The advantage of a simple joint stock company is, as in the case of a joint stock company, that a simple joint stock company is liable for the breach of its obligations with all its assets, but the shareholder is not liable for the company's liabilities. According to Mamojka [5], the complete separation of the company's assets from the shareholder's assets and the resulting controlled business risk will probably be one of the primary advantages of a simple stock company - the economic and legal and psychological comfort of the shareholder lies (among other things) in the fact his direct investment (ie a contribution to the share capital for which the company issues him a corresponding number of shares of a certain nominal value) and not his personal property. Although a simple public limited company is not a sub-type of public limited company, a number of legal provisions on a private public limited company will apply *mutatis mutandis* to a simple public limited company. At the same time, the Commercial Code also specifically defines which provisions on a joint-stock company will in no case be adequately applied to shares in relation to a simple company. In this respect, however, from a theoretical point

of view, a simple stock company has an ambiguous position. According to the explanatory memorandum, a simple public limited company should not be considered a type of public limited company, but on the other hand, almost all the provisions on a public limited company (except those specified above) also apply to a simple public limited company. We can therefore assume that this fact will be one of the reasons that a simple joint stock company will be considered as a special type of joint stock company, or both companies will be considered as organizationally and legally related business forms[6].

3. Practical experience with the simple joint stock company

A simple stock company is a new type of business company. It is therefore appropriate to ask whether it has become known to entrepreneurs since 2017 and, in particular, whether entrepreneurs and start-ups use it in practice. As of 15 December 2020, 1104 public companies, 1440 limited partnerships, 297,512 limited liability companies, 7998 joint stock companies and 258 simple joint stock companies were registered in the Corwin Commercial Register information system. The vast majority of joint stock companies in Slovakia have the character of private joint stock companies, t. j. their shares are not traded on the capital market.

Most of simple joint stock companies are engaged in the information technology sector, and in terms of the amount of share capital, most entities have chosen the amount of share capital in the range from 1.01 Euros to 100 Euros. Given the very low number of this type of company, it can be assumed that this type of company has not yet approached entrepreneurs. We can only assume the reasons for the lack of interest now, as we do not record a survey of the reasons why entrepreneurs do not use this type of business company[7].

Based on the current practical experience and the opinion of the authors, we assume such a reason that entrepreneurs do not know this new type of company sufficiently and due to ignorance do not use this company. Another reason is the fact that this type of company does not have an equivalent abroad and a potential foreign investor in a "start-up" may have reservations about investing in an unknown type of company that he does not know within its legal system. [8]

One of the possible reasons for not using this type of company may be less innovative projects in the Slovak Republic and the subsequent logical absence of such companies on the market. As part of its awareness in the small and medium-sized business sector, the Slovak Business Agency, as a specialized institution established by the Government of the Slovak Republic and the EU in 1993 to support this type of business, also points to its advantages.

If we take a closer look at the most successful start-ups in 2018 rated by Forbes magazine, all start-ups had the form

of a limited liability company and one form of a joint stock company. The most successful start-ups in 2019 at the Central European Startup [9] Awards competition again took the form of a limited liability company in most cases and a joint-stock company in two cases. For the area of risky investment in the registered capital of start-ups, a limited liability company is currently important and used mainly in the form of commercial companies. In the later stages of the life cycle, i.e. at a time when it is no longer a start-up company, a joint-stock company is also used. Companies in which the partners are liable for the company's liabilities with all their assets are generally not used as start-ups. Both a limited liability company and a joint stock company have certain disadvantages from the point of view of start-ups. In the case of a limited liability company, this is a more complicated possibility of flexible setting of external and internal relations of the company and effective use of common tools in the world, which allow setting and planning capital entry into the company and its exit from the company, as well as the ability to effectively motivate employees. resulting from the legal requirement for a minimum shareholder contribution (€ 750). In the case of a joint-stock company, it is too expensive for start-ups up to the advanced stage of their life cycle, the legally prescribed minimum share capital (€ 25,000), is also characterized by regulation for medium and large companies to trade their shares on the stock exchange and thus related increased demands to ensure the functioning of the company.

Legal regulation of a simple joint stock company, which, unlike a limited liability company, does not bring sufficient motivating benefits for a simple joint stock company to take over the position of a leader not only in the support of start-up projects. Based on such research, we believe that a simple stock company did not attract the business sphere of small and medium-sized enterprises. However, the current lack of interest does not mean that this form of business will no longer be used in the future.

4. Shares of the company

As the name of the company suggests, it is a simple joint stock company and the share in the company is expressed in the same way as in a joint-stock company through shares. In terms of the legal consequences of the creation and exercise of rights from a security, an action is traditionally understood as a declaratory and imperfect security. Declaratory means that the emergence of a legal relationship from a share between a shareholder and a joint stock company, i. e. the acquisition of the rights of a shareholder as a partner in a joint-stock company is not linked to the issue of a share. In a joint-stock company, before the establishment of the company, the shareholder does not have to repay the entire nominal value of the share. Such a shareholder is not issued a share, but only a temporary letter [10] (§ 175 in conjunction with § 176 Commercial Code), but the shareholder, regardless of the fact that he is not the owner of shares becomes a full shareholder of a joint stock company (§ 176a Commercial Code) with the same quality of rights in comparison with a

shareholder of a joint-stock company who has repaid the nominal value of the shares in full and to whom the share has already been issued. It follows from the above that in order to establish a legal relationship between a shareholder and a joint-stock company, it is not necessary to issue a share by a joint-stock company and hand it over to a shareholder. The shareholder acquires the full rights and obligations of the shareholder by registering the joint stock company in the Commercial Register. Jablonka [11] sees a certain controversy over the nature of shares in this regard in a simple joint stock company, as all deposits must be repaid before the establishment of the company (§ 220t par. 4 Commercial Code), unlike a joint-stock company. Even in this case, however, the shares will not be registered for the benefit of shareholders in the central depository on the day of registration of the simple joint stock company in the Commercial Register. One of the conditions for registering shares for the benefit of their owners is that a simple joint stock company must be registered in the commercial register. This means that a certain period of time elapses between the registration of a simple joint stock company in the commercial register and the registration of the owner of shares in the central depository. He believes that even a simple joint stock company is possible in accordance with § 220h par. 3 Commercial Code to apply § 176a par. 1 Commercial Code, i. e. the shareholder of a simple joint stock company becomes its full partner by registering the company in the commercial register, regardless of the fact that the shares are not yet registered in the central depository. To exercise the rights from the shares, the shareholder shall prove the legal relationship to the simple joint stock company by the founding agreement (§ 220u Commercial Code), which results in the structure of the company's shareholders, until the registration of shares in the central depository. It should be emphasized that in a simple company it is not possible to issue a temporary letter as a share replacement (§ 176 Commercial Code), as this can only be issued if the entire issue price of the shares is not paid before the company is registered, which in a simple joint stock company is not eligible (§ 220t para. 4 Commercial Code). On the basis of the above, it considers that a shareholding in the case of a public limited company as well as a simple joint stock company has the character of a declaratory security.

As in the case of a joint-stock company, the shares of a simple joint stock company are associated with the rights of the shareholder as a partner to participate in the management and profit of the company. The law of a simple company on shares allows the issuance of the company's shares exclusively in book-entry form and such shares can only be registered, in order to transparently identify the identity of the shareholders of the simple joint stock company kept in the public register of shareholders. Thus, a simple company cannot issue paper shares or book-entry bearer shares (unlike a joint-stock company). However, the advantage of a simple joint stock company is the possibility to issue shares with a nominal value in euro cents or in a combination of euros and euro cents, which is

not allowed for a simple joint stock company. It is also necessary to apply the ban on the issue of interest-bearing shares to a simple company (§ 159 para. 2 Commercial Code in conjunction with § 220h para. 4 Commercial Code). [12]

From the authors' point of view, the most important feature of the shares of a simple joint stock company is the possibility to issue shares with special rights, while Commercial Code has enabled this range of special rights associated with such shares very widely. The principle of the so-called "numerus clausus", t. j. that it is possible to issue only those types of shares that Commercial Code explicitly allows to issue. However, in the case of a simple joint stock company, it is possible to issue shares with special rights, while these special rights are stated in the law only demonstratively and therefore leave a great deal of creativity for the companies. This creativity is limited only by the express provisions of the Commercial Code, which generally prohibit the issue of shares with certain specifically defined rights. The Articles of Association may therefore regulate the variable segmentation of special rights of shareholders according to the extent to which the particular shareholder (investor) is important for the company, either in terms of its contribution (e.g. strategically located real estate, know-how, etc.) or influence on decision-making processes. society. For the sake of completeness of the above interpretation, we would like to add that the nominal value of the share is not decisive for the granting of special rights, i. from. the articles of association may grant various special rights to individual shares even if all the issued shares of the company have the same nominal value.

In the first place, in the case of a simple joint stock company, it is necessary to realize that the individual shareholders of a simple joint stock company may have an unequal position. This can also be perceived as a negative (especially for shareholders with a worse position), but on the other hand, it has its significance for the company. As Patakyová notes, the possibility to issue shares with almost unlimited special rights weakens the principle of equality of shareholders, and it is the unequal shareholder rights that is one of the features of a simple joint stock company. However, despite this asymmetry, all shareholders of the company are bound by a general obligation not to exercise their rights to the detriment of the rights and legitimate interests of other shareholders.

In the case of a simple joint stock company and issues of individual shares, it should be borne in mind that each of the issued shares may incorporate different rights or rights to a different extent and that each individual issue of an individual share may carry a different range of special rights belonging to that shareholder. Therefore, each of such shares may have a different scope of special rights, such as a different way of calculating votes at the general meeting, a different scope of the right to provide information about the company, a different scope of entitlement to profit sharing determined by the company's

decision in the articles of association. Therefore, within the Articles of Association, the simple joint stock company may adjust these rights at its discretion, most often these special rights differ with regards to the nature of the shareholder, his contribution to the company (whether property, personal or professional). The nominal value of individual shares does not play a role in the granting of such rights, and special rights may be granted regardless of the nominal value of the share. It is also possible to grant a share with a lower nominal value a greater range of special rights than shares with a higher nominal value.

5. Conclusion

According to the explanatory memorandum, a simple joint stock company is a separate legal form, but on the basis of application optics it represents a certain subtype of a joint-stock company. The legal form of a simple stock company was created to support start-ups. A simple joint stock company contains specific institutes, which, compared to a joint-stock company, allow a more flexible setting of shareholder relations between shareholders and the issuance of specific types of shares that cannot be issued in a joint-stock company.

The main advantages of a simple joint stock company are the need for a low share capital of 1 euro, the possibility of issuing shares with a nominal value of one euro cent and the ability to issue shares with different rights for shareholders who may not have an equal status.

The most common downward negative of a simple company on shares is the need to keep a register of shareholders in the central depository, which on the one hand causes the company increased costs and also suppresses the anonymity of the company's shareholders. It is also a little-known form of business company, especially from the point of view of foreign investors.

As mentioned above, a simple stock company also brings with it an effort for greater transparency in relation to the identity of shareholders, and its shares can only be issued as book-entry registered shares. Therefore, the register of shareholders of a simple joint stock company is public (as opposed to a non-public list of shareholders of a joint-stock company) and is maintained by the central depository, in the conditions of the Slovak Republic the National Central Securities Depository, a. s., (NCDSP). This register contains the information required by law and replaces the list of shareholders that would otherwise be maintained by the company itself. Data from the register are also available on the website of the Central Depository. The purpose of this database is to make the complete shareholder structure transparent in an effort to increase the decision-making flexibility of a potential investor who does not have to find out the shareholder substrate at length in the process of considering support for one of the start-ups. However, despite the above-mentioned register of shareholders, it cannot be ruled out that some of the shareholders of a simple company in shares have a contract on the exercise of rights from the relevant share

(or shares) in favour of third parties, i. from. the shareholders of a simple joint stock company registered in the register do not have to be the end users of the proceeds from the managed rights.

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CROSS BORDER TRANSFORMATIONS OF THE COMPANIES FROM ECONOMIC AND CRIMINAL LAW ASPECT WITH RESPECT TO DIRECTIVE (EU) 2019/2121

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Abstract: *The authors deal with the topics related to issues concerning the cross-border mergers in Slovak legal regime, the basis of such transaction and the reflections on the rights of employees and creditors. The topic of merger is also shown from the criminal law perspective. When defining the cross-border mergers, it is necessary to address the role of the notary in Slovak republic and its assessments of the transactions. Nevertheless, the authors also analyze the European Union's activities in the field of cross-border mergers and the adoption of new rules through Directive 2019/2121 as regards cross-border transformations, mergers and acquisitions. The general objective of the initiative and the adoption of the Directive is to develop the single market, deepen it and improve the responsible use of the opportunities offered by the single market in a fairer and more predictable way.*

Keywords: *merger, cross-border merger, notary, cross-border conversion, creditor protection*

1. Introduction

Apart from whether it is a merger or an amalgamation, the fact whether it is a national or cross-border merger is no less important. A domestic merger is a merger that will take place exclusively between the Slovak participating companies, i.e. in terms of the theory of registered office valid for the Slovak Republic, exclusively between companies domiciled in the territory of the Slovak Republic. Cross-border merger of companies means the merger or amalgamation of one or more Slovak participating companies with one or more foreign participating companies. [1] A Slovak participating company is a company domiciled in the territory of the Slovak Republic, a foreign participating company is a company domiciled in the territory of another Member State. [2] The law stipulates that in the case of a cross-border merger of companies, all the merging participating companies and the acquiring company must have a similar legal form, unless the law of the Member States in whose territory the participating companies have their registered offices allows for mergers or amalgamations. [3]

The draft contract on a cross-border merger must be drawn up in the same wording for all participating companies, the statutory bodies being responsible for its preparation. The approved content and text of the cross-border merger agreement must be identical and the terms of the agreement must be in accordance with the national rules on cross-border mergers in the States of the other participating companies.

A company carrying out a cross-border merger should also draw up a report providing information to its partners and employees. The report should explain and justify the legal and economic aspects of the proposed cross-border operation and the implications of the proposed cross-

border operation for employees. The report should also explain the consequences of the cross-border merger and the remedies available to the shareholders.

In relation to employees, the report should explain the implications of the proposed cross-border operation for the employment situation. The report should explain whether there will be a change in the terms of employment defined in the law, collective agreements, or group agreements and in the location of the business places of the company or subsidiaries. The information published by the company should be exhaustive and allow interested parties to assess the consequences of the proposed cross-border operation. However, companies should not be required to disclose confidential information the disclosure of which would harm their business position in accordance with Union or national law. [4]

The area of protection of employees' rights in the legal regulation of cross-border mergers is ensured through the operation of the so-called a special bargaining body for employees involved in the cross-border merger process. For the registration of a cross-border merger in the commercial register, it is necessary to prove the results of negotiations between the companies involved in the cross-border merger with the employees regarding their participation in the management of the successor company. The condition for registration and the annex to the register proposal is an agreement on the manner and extent of employee participation in management or a decision to terminate negotiations under a special regulation or a written statement by the statutory body that the deadline for negotiations under a special regulation has expired without concluding an agreement.

2. Shareholders and creditors in the process of merger

When regulating the special rights of shareholders regulated by the Slovak legal system in the process of

cross-border merger or amalgamation, in the process of cross-border transformation, the national legal regulation with some deviations is applied appropriately. For example, in the case of the law resulting from the disproportionate share exchange ratio, unlike a national merger (where a court decision granting a shareholder the right to a reasonable cash surcharge is a court decision binding on the successor company to determine other shareholders) mergers binding only on those shareholders suing for such remedy. Other shareholders of this company will not be entitled to a reasonable supplement at all. The specificity of the shareholders' right to repurchase shares in a cross-border merger is that the shareholders of a Slovak joint-stock company participating in a cross-border merger claim against this company regardless of whether the Slovak participating company is a merging company or a successor company. The successor company is subsequently obliged to provide the shareholder with adequate monetary consideration and the legal proceedings in question continue with the successor company in court in the Slovak Republic under Slovak law, if this fact was captured in the transformation agreement. [5]

Similar to national mergers, the creditors of a Slovak participating company (if it is a merging company and also if it is a successor company) have a significant right to demand that the fulfilment of their outstanding claims be adequately secured. However, this right belongs only to those creditors who have overdue receivables from the Slovak participating company as of the date of approval of the draft cross-border merger agreement or cross-border merger agreement. If the parties do not agree on how to secure the outstanding claim, the creditor may claim this right to adequate security of the claim in court against the Slovak participating company.

3. Role of the notary

The notary in Slovak republic has an important role in the process of cross-border merger compared to a national merger. [6] Compliance with the requirements laid down for a cross-border merger or cross-border merger with a Slovak participating company shall be examined by a notary and a certificate issued in accordance with a special regulation in the form of a notarial record before the cross-border merger or cross-border merger is entered in the commercial register. The notary shall certify the fulfilment of the conditions in the form of a notarial record on the basis of the submitted documents and the notary shall state in the notarial record the fulfilment of which conditions he certified and how their fulfilment was proved and attach a certification clause stating that he did not find any obstacles.

According to the Slovak legislation, a notary has a particularly demanding and specific role, as Slovak law does not clearly specify the scope of the notarial examination and does not specifically specify all the facts that need to be examined. These facts are not limited only to the facts stated in the Commercial Code, but also to those stated in other sectoral regulations governing, for

example, competition law or tax issues. In some cases, the Commercial Code stipulates that a notary may not issue such a certificate. These are, for example, cases where legal proceedings are pending to determine the security of creditors of a Slovak participating company and the draft cross-border merger or cross-border merger agreement does not contain an agreement on court jurisdiction and applicable law, or in other cases related to breach of Slovak participating companies' obligations. The effects of a cross-border merger occur by its entry in the commercial register. Following the entry of a cross-border merger in the commercial register, a declaration of invalidity of that merger may not be sought. The Commercial Code does not allow an effective cross-border merger to be declared invalid after its entry in the Commercial Register [7].

4. The European Union's activities in the field of cross-border mergers and the adoption of new rules through Directive 2019/2121

As merger can have a major impact on all relations within a company, each Member State of the European Union pays special attention to the issue of such transformation. In the essence of the transformation they represent a significant transaction within the capital markets and very often as a result there is a so-called agency problems, i.e. problems between the owners of the company, i. e. the shareholders of the company, and the management of the company, represented by its statutory bodies. [8]

The European Commission has assessed the impact of current European regulation on cross-border mergers in assessing the current state of cross-border business activities and possible potential changes in this area. The Commission has stated that, at European level, companies play a key role in promoting economic growth, creating jobs, attracting investment in the European Union and helping the economic stability of the European Union as a whole. They help to bring greater economic and social value to society as a whole. To achieve this, companies must operate in an environment that leads to growth and is adapted to meet the new economic and social challenges of an increasingly globalized and digital world. However, cross-border operations of companies can have a significant impact on the relevant stakeholders as well as on society as a whole. It is therefore essential that the protection of persons involved in the company's cross-border operations, in particular employees, creditors and minority shareholders, keep pace with the growing transnationalisation of companies and that Member States' authorities be able to take action against abusive practices against such persons. [9]

The current situation of cross-border mobility within the European Union provides a very fragmented picture. The existing legal framework only lays down rules for cross-border mergers, while cross-border divisions are subject to national rules (if such national rules for cross-border divisions exist at all). In addition, it is not always certain which law applies to the internal functioning of companies operating in more than one EU Member State. As regards

national legislation on cross-border divisions, less than half of the Member States [10] lay down specific rules on cross-border divisions, or their implementation is possible through relevant case law. Although Member States allow companies to split across, the relevant national provisions often differ or even be incompatible. As with cross-border mergers, cross-border divisions affect the rights of stakeholders, such as employees, creditors or minority shareholders.

There is a clear added value in addressing these issues at EU level. The current problems are mainly due to differing national rules, a lack of appropriate rules or the need to modernize current EU rules. Member States acting individually cannot sufficiently remove obstacles to the freedom of establishment, as national rules and procedures would have to be compatible with each other in order to operate in a cross-border situation. Similarly, Member States acting alone cannot create guarantees for stakeholders in cross-border situations. The Court of Justice has repeatedly recognized that not all differences in national rules can be resolved by case law, but will need to be addressed by future legislation or conventions. [11] In the absence of harmonized rules at EU level, the case law of the Court of Justice has developed principles based on freedom of establishment, in particular regarding cross-border "crossings", but also on the recognition of companies registered in another Member State. [12]

As regards the protection of creditors and minority shareholders, minimum levels are laid down at European level, in particular procedural rules, and substantive law is subject to national law. Therefore, there are still differences between the substantive law of the individual EU Member States. In relation to creditors, it is established at European level under the relevant Directive that creditors are protected under national law without further specifications. Similarly, the Directive lays down only some rules concerning shareholders in general (for example, the provision of information through draft terms of merger, reports of statutory bodies, voting at general meetings), but is left to Member States to deal with possible further protection of minority shareholders. At present, companies often face costly legal advice and a very long time horizon to complete a merger due to differing national rules. This is due to the different deadlines of the authorities for issuing merger certificates or the different protection periods for interested parties in different Member States. The current minimum requirements of European legislation for the national rules on the protection of creditors and minority shareholders set out in the Directive create legal uncertainty. Due to the lack of specific guarantees and harmonized rules, creditors and minority shareholders have greater rights in some Member States than in other Member States or suffer from a lack of protection in some Member States.

For these reasons, the Commission has taken the initiative leading to the adoption of Directive (EU) No 182/2011 of the European Parliament and of the Council. 2019/2121 of

27 November 2019 amending Directive (EU) 2017/1132 as regards cross-border transformations, mergers and acquisitions. The general objective of the Commission's initiative and the adoption of the Directive is to develop the single market, deepen it and improve the responsible use of the opportunities offered by the single market in a fairer and more predictable way. It should stimulate employment, growth and investment, in order to have a positive impact on small and medium-sized enterprises. It also aims to reduce unnecessary costs and burdens on companies in connection with the cross-border merger cycle and to provide effective protection to other stakeholders (employees, creditors, minority shareholders and third parties). The aim is to protect the rights of minority shareholders in carrying out a cross-border operation by providing adequate rights, by having the same level of guarantees in all EU Member States. It is also intended to help companies exercise their freedom of establishment while ensuring that creditors are not adversely affected by such cross-border transactions and that they are able to enforce their claims. The aim of the proposal is to ensure legal certainty and benefits for creditors by providing the same level of guarantees and compatible rules within the EU.

Cross-border reorganization of the company may also result in changes in employee rights. Such rights are protected in particular through the guarantees provided by EU labor law. The Directive will introduce guarantees for employee participation at employee level and for the protection of acquired employee rights. In addition, in cross-border mergers, transparency will be provided to employees on the impact of the cross-border operation on jobs. Simpler rules for cross-border operations aim to increase the efficiency of companies and increase competitiveness.

In addition to the new rules on mergers, the Directive lays down rules on cross-border divisions, whether partial or complete, but these rules only cover cross-border divisions related to the creation of new companies. The Directive does not provide a harmonized legal framework for cross-border divisions in which a company transfers its assets and liabilities to one or more existing companies, as such cases are considered very complex as they require the involvement of competent authorities from several Member States and also bring additional risks in terms of circumvention of Union and national rules.

Under Article 160b of the amended directive, a new form of cross-border division is introduced in the case of cross-border division of a company, namely the so-called partial division. The process of partial division consists in the company being divided transfers part of its assets and liabilities to two or more acquiring companies. In return for these assets, the company being divided acquires securities or shares in the acquiring companies. It is a certain parallel of the process of establishing a business company by making a non-monetary contribution to another company. In its opinion, the Ministry of Justice of

Slovak republic stated that the Slovak Republic has no reservations about the general nature of the intention to define the terms. However, it seems necessary to examine thoroughly and carefully the effects of the definitions on the national rules governing capital companies, as well as the terminology used, in the interests of clarity in the application of its provisions.

Given the complexity of cross-border mergers and the number of interests involved, the Directive also imposes an obligation to ensure that the legality of cross-border transactions is checked before they enter into force in order to provide legal certainty. To that end, the competent authorities of the Member States concerned should ensure that the decision approving a cross-border operation is taken in a fair, objective and non-discriminatory manner and on the basis of all relevant elements required by EU and national law. In certain circumstances, the right of companies to carry out a cross-border operation could be abused for unfair or fraudulent purposes, such as circumventing employees' rights, evading social security benefits or tax obligations, or for criminal purposes. It is important to take action especially against the so-called box companies set up for the purpose of evading EU law or national law or of circumventing or infringing it. If, when examining the legality of a cross-border operation, the competent authority finds, even in consultation with the relevant authorities, that the cross-border operation pursues unfair or fraudulent objectives.

The competent authority should also be able to obtain from the company carrying out the cross-border operation or from other competent authorities, including the Member State of destination, all relevant information and documents so that it can check the legality of the cross-border operation within the procedural framework provided by national law. Member States should be able to determine the possible consequences for the certification of a previous operation of the procedures initiated by shareholders and creditors in accordance with the Directive. In making the assessment required to obtain a previous operation certificate, the competent authority should be able to use the services of an independent expert. Member States should lay down rules to ensure that the expert or legal person on whose behalf the expert acts is independent of the company applying for the previous operation certificate. The expert should be appointed by the competent authority and should not have past or present ties to the company concerned that could affect the independence of the expert.

5. Conclusion

Member States should provide for procedural guarantees in accordance with the general principles of access to justice, including the possibility to review the decisions of competent authorities in proceedings concerning cross-border operations, the possibility to suspend the certificate and allow interested parties to bring an action before the competent court. Shareholders should therefore be granted the same minimum level of protection regardless of the

Member State in which the company is located. Member States should therefore be able to maintain or introduce additional rules for the protection of shareholders, provided that such rules do not conflict with the rules laid down in the Directive or with the freedom of establishment. The individual rights of shareholders to information should remain unaffected. The calculation of the cash compensation offer should be based on generally accepted valuation methods. Shareholders should have the right to challenge the calculation and question of the adequacy of monetary compensation before the competent administrative, judicial or delegated authorities under national law, including arbitration tribunals. Minority shareholders who do not agree with the merger will be able to leave the company and receive monetary compensation for their shares.

It may be that a cross-border operation could affect the claims of the former creditors of the company or companies who carried out the operation if the company liable for the debt is governed by the law of another Member State after that operation. At present, the rules for the protection of creditors in the Member States differ, which significantly increases the complexity of a cross-border operation and leads to uncertainty for the companies concerned as well as for their creditors as regards the grant or fulfilment of their claims. In order to guarantee adequate protection for creditors if they are dissatisfied with the protection offered by the company under the draft contract and if they have not reached a satisfactory solution with the company, creditors who have informed the company in advance should be able to request guarantees from the competent authority. In assessing such guarantees, the competent authority should take into account whether the creditor's claim against the company or a third party has at least the same value and comparable credit quality as before the cross-border transaction and whether it can be enforced within the same jurisdiction. Member States should ensure adequate protection for those creditors who have entered into a relationship with a company before it has announced its intention to make a cross-border conversion. Following the publication of a draft cross-border conversion agreement, creditors should be able to take into account the potential impact of a change in jurisdiction and applicable law as a result of the cross-border conversion. Creditors to be protected could include current and former employees with acquired occupational pension rights and persons receiving pension benefits. In addition to the general rules, Member States should provide that such creditors have the right to claim in the Member State of origin for a period of two years from the entry into force of the cross-border conversion. The two-year protection period provided for in the Directive in relation to the jurisdiction to which creditors with claims may appeal before the period of publication of the draft cross-border conversion contract should be without prejudice to national law defining the limitation period for claims. The involvement of all stakeholders in cross-border operations, in particular the involvement of employees, contributes to the long-term

and sustainable approach of companies throughout the internal market. In this respect, the protection and promotion of employees' rights to participate in co-decision within the company's management has an important role, especially in the cross-border relocation or restructuring of the company. The successful conclusion of negotiations on co-decision rights in cross-border operations is therefore crucial and should be encouraged.

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- [3] This provision cannot be interpreted as meaning that a cross-border merger is possible only in cases of a clearly identical legal form of the participating companies. Such an interpretation would be aimed at restricting the right of establishment and the right of free movement under the TFEU and in conflict with the decision of the CJEU in the case of SEVIC Systems AG, no. C-411/03.
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- [10] E.g. Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Spain, Finland, France, Italy, Lithuania, Luxembourg, Romania, the Netherlands, Portugal, Sweden, Spain and the United Kingdom
- [11] Case C-81/87, section. 21 až 23, C-208/00, section. 69, C-210/06, section 108
- [12] Decisions of ECJ „Cartesio“, „Vale“, „Centros“, „Inspire Art“

ENACTMENT OF CRIMINAL LIABILITY OF SLOVAK BUSINESS COMPANIES AND ITS EVOLUTION

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Abstract: *The need to introduce an effective model of punishment, respectively. sanctioning of legal entities for illegal conduct has already resulted in the Slovak Republic from the negotiations on accession to the European Union. During the negotiations on accession to the European Union, the Slovak Republic undertook to introduce criminal liability of legal persons only after accession to the European Union, as part of the recodification of criminal law in 2005[1]. In 2021, five years have passed since the current legal regulation persons, therefore its application can be balanced and current and future trends can be evaluated. Authors evaluate the enactment of criminal liability of Slovak business companies and its evolution and try to emphasize the positive and negative trends within the newly enacted concept of criminal liability.*

Keywords: *criminal liability, effective model of punishment, criminal liability of legal persons, evolution of liability, persecution*

1. Introduction

Criminal liability of legal persons represents a separate chapter of criminal law in the conditions of the legal order of the Slovak Republic. In the past, the content of this chapter was mainly the differences of opinion of the professional public, which were reflected in the initial unsuccessful attempts to introduce the so-called true criminal liability of legal persons in the period of recodification of criminal codes. Failure to introduce true criminal liability resulted in an "experiment", which was the introduction of the so-called false, resp. pseudo criminal liability of legal persons. The given legal regulation was rejected by application practice, which concisely documents the zero use of related legal institutes of false criminal liability of legal persons in practice. The ten-year development and preparation of the legal regulation of criminal liability of legal entities in the conditions of the Slovak Republic has reached the anchoring of the so-called true criminal liability of legal persons, following the example of the Czech Republic, whose legal regulation was to a large extent an inspiration for the Slovak legislator. The institute of true criminal liability of legal entities was enshrined on 1 July 2016, when Special Act no. 91/2016 Coll. on Criminal Liability of Legal Entities (hereinafter referred to as "ZoTZPO") and on Amendments to Certain Acts. The legal regulation in question derogates from the legal regulation of false criminal liability in Act no. 300/2005 Coll. The Criminal Code, as amended (hereinafter referred to as the "Criminal Code" or the "Criminal Code") and at the same time introduces a model of true criminal liability of legal persons based on the concept of attributability. The year 2021 is a milestone and a decade of the effectiveness of the Czech legal regulation of criminal liability of legal entities, t. j. Act no. 418/2011 Sb. The Act on Criminal Liability of Legal Entities and Proceedings Against Them (hereinafter "ZoTOPO"), which, in addition to a very similar structure of provisions and related case law, can provide a potential basis for predicting trends in the application of ZoTZPO for the coming years.

2. Criminal liability of legal entities in the Slovak Republic during the 5 years of effectiveness of ZoTZPO

Act no. 91/2016 Coll. on Criminal Liability of Legal Entities and on Amendments to Certain Acts is a special law that has become part of the basic legal regulations governing the area of substantive and procedural criminal law. From the point of view of the mutual relation of the law in question to the general criminal law regulations, which are the Criminal Code and Act no. 301/2005 Coll. The Criminal Procedure Code, as amended (hereinafter referred to as the "TP" or the "Criminal Procedure Code"), is a ZoTZPO amendment to the *lex specialis*. Subsidiary application of the Criminal Code and the Criminal Procedure Code follows from the provision of § 1 par. 2 ZoTZPO, according to which "... unless this Act provides otherwise and unless the nature of the matter precludes it, the criminal liability of a legal person and penalties and protective measures imposed on a legal person shall be governed by the Criminal Code and criminal proceedings against a legal person shall be governed by the Criminal Procedure Code. ". The *Lex Generalis*, which are the general provisions of the Criminal Code and the Criminal Procedure Code, therefore apply only if there is no special provision on the issue and if this does not preclude the nature of the case. The subject of the ZoTZPO legal regulation are both substantive and procedural provisions of criminal liability of legal entities and its scope is defined in § 1 par. 1, which can be divided into three basic areas:

- a) introductory provisions and bases of criminal liability of legal entities (subject of the law and its relation to other laws, scope of the law, criminal offenses of legal entities, criminal liability of a legal entity - based on the model of i attributability, exclusion of criminal liability of certain legal entities, issues of defining a legal entity as perpetrator, complicity, participation, criminal liability of the legal successor of the legal person, effective remorse and eradication of the conviction),

- b) criminal sanctions (principles on the imposition of penalties and protective measures and individual types of penalties and protective measures); and
- c) procedure in criminal proceedings against legal persons (relation to proceedings on administrative tort, local jurisdiction, notification of commencement and termination of criminal proceedings, change of dissolution and termination of a legal person, restrictive and precautionary measures, proceedings on behalf of a legal person in criminal proceedings, lawyer, interrogation, concluding remarks, last word and provisions on the execution of individual sentences).

The model of true criminal liability of legal entities in the Slovak Republic can be described in a simplified way through the obligatory features of criminal liability of legal entities.

The offense was committed by a legal person if the following conditions were cumulatively fulfilled that:

- a) an offense from an exhaustive calculation (§ 3 ZoTZPO),
- b) was committed by a natural person in a certain relationship with a legal person (§ 4 para. 1 and para. 2 ZoTZPO),
- c) for its benefit or on its behalf or within its activity or through it (§ 4 para. 1 ZoTZPO) and
- d) has been attributed to a legal person (§ 4 ZoTZPO)[2].

3. Evolution of Slovak law with regards to criminal liability of legal persons

Despite the fact that ZoTZPO has been effective for just over five years, it has been amended ten times during this time, including four indirect amendments. In an effort to categorize the nature of the amendments in question, we came to the conclusion that, in essence, the nature of the amendments in relation to ZoTZPO can be divided into two categories:

- a) amendments extending or modifying the scope of criminal offenses in § 3 of the ZoTZPO, for which a legal person may be criminally liable. It can be stated that every single amendment has expanded or modified the range of criminal offenses for which a legal person may be criminally liable. The change meant that, in addition to about two dozen offenses, a legal person could be criminally liable for any other offense. Despite the fact that in the conditions of the Slovak Republic the ratio between crimes in ZoTZPO and the remaining crimes in the Criminal Code is not so significant, the fact that each amendment extended the calculation of § 3 ZoTZPO foreshadows a trend of gradually expanding range of crimes. It can then be argued that although on the one hand the way of change is not the same model (in the context of expanding the range of crimes in the Slovak Republic - "evolution" in terms of gradual increase in crime, and in the Czech Republic - "revolution" in terms of conceptual

change from positive calculation to negative calculation of criminal offenses), on the other hand, the parallels of similarity of the result of changes are more than obvious, in terms of the extension of the scope of criminal offenses for which a legal person may be criminally liable. Of course, it is worth considering the suitability of the above-mentioned models, especially in relation to predictability of the law and legal certainty. However, we are of the opinion that from the changes in question it is expected for subjects that the scope of criminal liability of legal entities will increase and the only definitive imperative for the legislator will be to assess the possibility of committing a crime by a legal entity, given its nature (see § 1 para. , accepting the possibility of the absence of a given limit, since in terms of the concept of imputability, the criminal offense of a natural person is attributed to a legal person in accordance with the conditions of § 4 ZoTZPO. For completeness to the given category of legislative changes, we also present the calculation of amendments to the ZoTZPO modifying (in some cases it is an extension of the calculation in others only a legislative-technical change of the crime name) the scope of criminal offenses in § 3 ZoTZPO:

i. Act no. 316/2016 Coll. - fraud according to § 213 Penal Code (hereinafter referred to as "TZ"), fraud according to § 221 TZ, credit fraud according to § 222 TZ, insurance fraud according to § 223 TZ, capital fraud according to § 224 TZ, subsidy fraud according to § 225 TZ, fraudulent bankruptcy according to § 227 TZ, guilty bankruptcy according to § 228 TZ, operation of dishonest games and bets according to § 229 TZ, unauthorized operation of lotteries and other similar games according to § 230 TZ, damage to the creditor according to § 239 TZ, favoring the creditor according to § 240 TZ, unauthorized business according to § 251 TZ, data distortion economic and commercial records according to § 259 and 260 TZ, misuse of information in business relations according to § 265 TZ, market manipulation according to § 265a TZ, machinations in public procurement and public auction according to § 266 and 267 TZ, obstruction of execution of official decision according to § 348 and 349 TZ, establishment, support and promotion of the movement aimed at the suppression of fundamental rights and freedoms according to § 421 TZ, expression of sympathy for the movement aimed at the suppression of fundamental rights and freedoms according to § 422 TZ, denial e and approval of the Holocaust, crimes of political regimes and crimes against humanity according to § 424 of the Criminal Code, apartheid and discrimination of a group of persons and inhumanity according to § 425 of the Criminal Code[3],

ii. Act no. 161/2018 Coll. - terrorist attack according to § 419 TZ, certain forms of participation in terrorism according to § 419b TZ, terrorist financing according to § 419c TZ, travel for the purpose of terrorism according to § 419d TZ,

iii. Act no. 214/2019 Coll. - violation of the obligation to manage foreign property according to § 237 of the Criminal Code, unauthorized production of alcohol, tobacco and tobacco products according to § 253 of the Criminal Code, violation of regulations on circulation of goods in contact with foreign countries according to § 254 of the Criminal Code, violation of regulations on state technical measures for marking goods 279 TZ, falsification and alteration of public deed, official seal, official seal, official emblem and official mark according to § 352 TZ, violence against a group of inhabitants according to § 359 TZ, dangerous threat according to § 360 TZ,

iv. Act no. 474/2019 Coll. - support and promotion of sexual pathological practices according to § 372a TZ,

v. in. Act no. 288/2020 Coll. - cruelty to animals pursuant to Section 305a of the Criminal Code, neglect of animal care pursuant to Section 305b of the Criminal Code, organization of animal matches pursuant to Section 305c of the Criminal Code,

vi. Act no. 312/2020 Coll. - unauthorized production and use of a means of payment pursuant to Section 219 of the Criminal Code, acceptance and provision of an undue advantage pursuant to Sections 336c and 336d of the Criminal Code;

b) Amendment (Act No. 312/2020 Coll.) amending the scope of the regulation of criminal sanctions of legal entities in ZoTZPO. The provisions of the ZoTZPO before the mentioned amendment explicitly contained only the legal regulation of the second sentence. Which in practice meant that a protective measure could be imposed on a legal person if it met the criterion under § 1 para. 2 ZoTZPO, that is to say, if the nature of the case did not preclude it. The given amendment also introduced into the calculation of types of criminal sanctions a protective measure of confiscation of a part of the property, which in accordance with § 10 par. 2 ZoTZPO imposes according to the conditions enshrined in § 83a TZ. We consider the given method of legislative addition of a protective amendment to the ZoTZPO to be unsystematic, because in the given case it is not at all clear whether it is possible to impose other legal measures regulated exclusively in the Criminal Code on a legal person. that the legislator in the legislative wording also adds the term protective measure in a single number to general provisions (eg § 1 para. 2, § 7 para. 1 and 3 and finally also in the title of the third part of ZoTZPO), which evokes the impossibility of imposing another protective measure as a protective measure of confiscation of part of the property within the meaning of ZoTZPO. Although in most other protective measures regulated exclusively in the Criminal Code, the nature of the case precludes their imposition on a legal person (eg detention or protective treatment), the imposition of a protective measure of confiscation under § 83 of the Criminal Code appears especially in cases where 14 ZoTZPO with reference to § 60 and § 83 par. 1 TZ.

Our predicted trend, in the context of legislative changes to the ZoTZPO, will be the continuation of expanding the scope of the exhaustive calculation of criminal offenses and possible refinement of the ZoTZPO provisions (eg regulation of the possibility of imposing other protective measures such as confiscation of part of property). Possible systemic changes (eg the possibility of a legal person developing in attributing the crime of a statutory body) could occur in the case of criminal cases of legal persons of the "big fish" nature, which could protect not only their trade name but also their existence. within the framework of the rights of the defense to allege infringement of fundamental criminal law principles in the context of certain provisions of the ZoTZPO.

4. Criminal records and related statistics

As From our point of view, the registration of the criminal record of legal entities has a great benefit for determining the criminological profile of a legal entity and the overall knowledge of the criminality of legal entities. The introduction of criminal liability of legal entities into the legal order of the Slovak Republic also amended Act no. 330/2007 Coll. on the Criminal Register and on Amendments to Certain Acts, as amended (hereinafter referred to as the "Criminal Register Act").

The necessary systemic change was the introduction of a special criminal record for legal persons. Pursuant to Section 10a of the Criminal Register Act, data from the criminal record of legally convicted legal persons necessary for the purpose of verifying the integrity and reliability of a legal person are kept in a list published on the website of the Prosecutor General's Office. A fundamental difference from the criminal record is its public availability, which means that we can examine the full set of legally convicted legal entities in real time. In the register in question, in accordance with § 4 par. 1 letter b) to f) of the Criminal Register Act published i) business name or title, ii) registered office of the legal entity, iv) identification number of the legal entity, v) register in which the legal entity is registered, vi) courts that ruled in the first instance and in appeal proceedings and their file marks, including the date of issue of the decision and the date of entry into force of the decision; restrictions or obligations, (viii) information on changes in the decision in the appeal proceedings and (ix) information on changes related to the execution of the sentence or protective measure

In terms of available data from the criminal record website, it appears that as of 29 September 2021, 101 legally convicted legal entities were registered. The advantage of a given register, in contrast to statistical data collected and published on a periodic (eg annual) basis, is its availability in real time, which allows for a more efficient and operational evaluation of criminal trends in legal entities. If we compare the given statistic - 101 legally convicted legal entities for approximately 5 years of ZoTZPO's effectiveness with the realities in the Czech Republic, it can be stated that 186 legal entities were

convicted for five years of ZTOPO's effectiveness, which in the context of criminological indicators of the compared states.

In the discussion on the need to introduce real criminal liability of legal persons, the opinions of opponents of its adoption emerged, also in the sense that the legal regulation of criminal liability of legal persons will be abused in the competition[4]. The above-mentioned figure, 101 legally convicted legal entities for 5 years of effectiveness of ZoTZPO, refutes the given assumption. However, if we take a closer look at the comparison of crime indicators in the comparison of natural and legal persons, we will come to a clear conclusion. According to the statistical data of the Ministry of Justice of the Slovak Republic for 2020, 27,907 persons were prosecuted, of which 27,838 were natural persons and only 69 were legal persons prosecuted. In terms of convictions, there are a total of 25,392 persons, of which 25,327 natural persons and 65 legal persons were convicted natural persons. Therefore, if we focus on the number of criminal prosecutions, then in the calendar year 2020, out of the total number of prosecuted persons, only 0.36% were legal persons, which is a really negligible amount. From the point of view of the end of criminal proceedings, however, the sketched indicator of the ratio of criminal prosecutions and convictions of persons is also interesting. While 90.98% of prosecuted natural persons are convicted of natural persons, up to 94.2% of legal persons are convicted of legal entities. Equally remarkable is the fact that almost 1/6 of convictions of legal persons were in the form of approval of a guilt and punishment agreement (10 out of 65 cases), but for natural persons there were only 1,520 concluded guilt and punishment agreements out of 25,327 convictions, which means that this is about 1 in 20 cases. Although the present article is rather descriptive in the context of monitoring selected trends in the application of criminal liability of legal persons, in the future it will be interesting to monitor, compare and analyze metadata and indicators, which we briefly outline above, especially, but not only in relation to parallels the effectiveness of prosecution natural persons and against legal persons.

Year 2020 was the fifth year of ZoTZPO application, and despite the fact that in that year the world was hit by a coronavirus pandemic on a global scale, when the activity of not only individuals but also legal entities was subdued, the decline in activity did not directly affect the development of corporate crime[5]. In 2019, 33 legal entities were prosecuted and convicted in the conditions of the Slovak Republic, and in 2020 this number doubled to 69 prosecuted and 65 convicted legal entities. An interesting statistical figure is also the number of crimes for which legal persons were convicted in 2020, 97 crimes committed by 102 acts. It can be deduced from the above that legal persons have committed a large number of criminal offenses in approximately one third of cases.

When focusing on the available data on the type of crime of legal entities, it can be clearly stated that legal entities

commit mainly tax crimes. The most frequently committed criminal offense in 2020 was the criminal offense of non-payment of tax and insurance premiums pursuant to Section 278 of the Criminal Code, for which 45 legal entities were convicted, which represents approximately half of the total number of criminal offenses for which legal entities were convicted. When we add to the given number the second most frequently committed crime of non-payment of tax and insurance premiums according to § 277 of the Criminal Code, which was committed in 32 cases, we come to the conclusion that tax crime of legal entities represents 4/5 of total crime of legal entities in the Slovak Republic in 2020. An interesting fact is that the range of crimes for which legal persons are convicted is gradually expanding, while in 2020 they were convicted for 16 different crimes. This fact may also be related to the extension of the exhaustive calculation of criminal offenses in § 3 of the ZoTZPO, for which criminal liability may be inferred against a legal person.

According to the ZoTZPO, it is possible to impose 9 types of penalties on legal persons in criminal proceedings. In 2020, the most frequently imposed type of punishment became a fine, which was imposed on 50 of the 65 convicted legal entities. The imaginary second place was occupied by the penalty of prohibition of activity and the penalty of publication of a conviction, each of which was imposed in 8 cases. For the sake of completeness, we add that the penalty of publishing a conviction can be imposed in accordance with § 11 para. 4 ZoTZPO only in addition to another type of punishment. In five cases, the most severe punishment was imposed, which is the penalty of dissolution of a legal entity. The last type of sentence imposed in 2020 is a forfeiture sentence, which was imposed in only one case. In investigating why in none of the cases was the penalty of a ban on receiving assistance and support provided from European Union funds imposed, since in accordance with § 18 par. 1 ZoTZPO is its obligatory imposition in the event that a legal person is convicted of a criminal offense committed in connection with a request for assistance and support provided from European Union funds. Above in Table no. 2 we register two legal entities convicted of the criminal offense of damaging the financial interests of the European Union under § 261 of the Criminal Code, but by searching them we came to the conclusion that the records show that the legal entities in question were sentenced to dissolution the support provided by European Union funds to the liquidated legal entity simply made no sense. In the present case, however, it is also up to the legislator to consider *de lege ferenda* the exclusion of the simultaneous imposition of the obligatory fines (within the meaning of § 17 para. on the penalty of a ban on receiving assistance and support provided from European Union funds together with a penalty and within the meaning of § 19 paragraph 1 of the ZoTZPO on a penalty of a ban on participation in public procurement)

5. Conclusion

The real criminal liability of legal persons represents, both in the conditions of the Slovak Republic and in the conditions of the Czech Republic, a legal instrument still unverified and immature in practice. The legal regulation of ZoTZPO has been effective for about 5 years and the Czech ZoTOPO, as its twice as "older brother", has been effective for almost 11 years. Both legal regulations were, as promulgated, the wording of the laws in terms of individual provisions is very similar, and it is no secret that the Slovak legislator was largely inspired by the Czech legislation. It was therefore interesting to follow the normative development of the legal regulations in question over time and the intervention of legal amendments (ZoTZPO - 10 amendments and ZoTOPO - 11 amendments). A common indicator, although in a different way (ZoTZPO - extension of the exhaustive calculation of criminal offenses and ZoTOPO - change of the model of positive calculation of criminal offenses to negative calculation of criminal offenses for which legal persons cannot be held criminally liable), is the trend of extending criminal liability of legal persons with an expanding range of criminal offenses. acts. In the future, it can be predicted that ZoTZPO will continue this trend, as so far every single amendment has brought an extension of the exhaustive calculation of criminal offenses.

From the analyzed statistical data, it is possible to state the trend of a gradual increase in criminal prosecutions as well as convictions of legal entities, as well as the widening range of criminal offenses for which legal entities have been legally convicted[6]. In 2020, in the conditions of the Slovak Republic, out of 68 prosecuted legal entities, 65 legal entities were convicted for 97 criminal offenses, of which up to 81 were tax criminal offenses, from which it can be concluded that in terms of the criminological profile of the legal entity the clear nature of tax infringements.

When predicting future trends in the application of ZoTZPO, also with regard to the practice of the Czech Republic, we would like to express the opinion that in addition to continuing to increase the prosecution of legal entities, it is possible to expect the occurrence of application problems. criminal offense of its statutory body (compare § 4 para. 1 to 3 ZoTZPO with § 8 para. 5 ZoTOPO) or the possibility of prosecuting a legal person without identifying the unlawfully acting natural person. [7] However, the great advantage of ZoTZPO, as the younger brother of ZoTOPO, is that the application practice in the Czech Republic has already solved similar cases and therefore we will be able and able to rely on its decision-making practice.

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PARTICIPATORY BUDGETING IN THE CONDITIONS OF TERRITORIAL SELF-GOVERNMENT OF THE SLOVAK REPUBLIC

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Abstract: Participatory budgeting is a form of citizen participation in which citizens are involved in the process of deciding how public money is spent. In Slovakia, participatory budgeting represents one of the relatively new instruments of political participation. The aim of this paper is to identify the current state of use, positives, and negatives of the implementation of participatory budgeting in the conditions of territorial self-government of Slovakia.

Keywords: participatory budgeting, territorial self-government, the Slovak Republic

1. Introduction

Participatory budgeting is a democratic process in which community members decide how to spend part of a public budget. It gives people real power over real money [1]. Participatory budgeting began in Porto Alegre in Brazil in 1989 and was credited with shifting priorities to better support the poorest parts of the city, improving services, infrastructure, governance, and increasing citizen participation. Since its start the participatory budgeting has been applied in Africa, Asia as well as North America. Local governments in Europe have embraced it to such extent that one third of all participatory budgeting initiatives worldwide is being implemented in this part of the world. Participatory budgeting in Slovakia has a different concept than other countries [2] [3] [4] [5].

2. Participatory budgeting

Participatory budgeting programs are innovative policymaking processes. Citizens are directly involved in making policy decisions. Forums are held throughout the year so that citizens can allocate resources, prioritize broad social policies, and monitor public spending [6].

Participatory budgeting can take on different forms, depending on where and how it is implemented. But PB programs share certain basic traits:

1. Information sessions: Citizens are given access to information about the cost and effect of different government programs.
2. Neighborhood assemblies: Citizens articulate local budgetary needs.
3. Budget delegates: Some citizens sign up to directly interact with government officials and draft viable budget proposals.
4. The vote: A larger group of residents votes on which projects to fund [7].

The COVID-19 pandemic in 2020 has affected daily lives of citizens and changed the regular patterns of behaviour, practices, and processes. At the same time, it impacted the economic side of life. National as well as sub-national

governments had to deal with a loss of income on the one hand and increase in costs in some specific areas on the other. Therefore, also because of the above facts, the question arises as to how these circumstances affected the participatory budgeting of the local governments in Slovakia [8].

2.1 Participatory budgeting in territorial self-government of Slovakia

Territorial self-government in Slovakia consists of regional and local level. The regional level of territorial self-government is represented by regions and the local level is formed by municipalities.

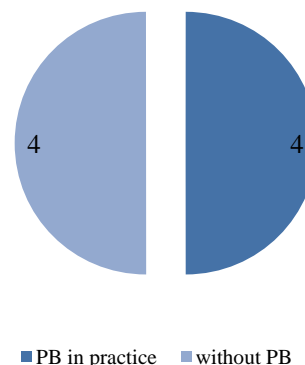


Figure 1: The participatory budgeting implementation in regional level of territorial self-government of Slovakia

There are eight regions in Slovakia. The concept of participatory budgeting has been implemented in practice by four regions (the Trenčín Region, the Bratislava Region, the Žilina Region, and the Trnava Region). The four regions have no experience with participatory budgeting. Participatory budgeting is applied for the longest time by the Trenčín Region and the Bratislava Region allocates the most funds.

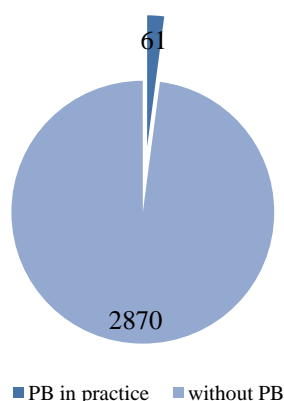


Figure 2: The participatory budgeting implementation in local level of territorial self-government of Slovakia

There are currently 2 931 local governments with their own budgets in Slovakia. This number includes all municipalities (2 890), the capital city - Bratislava, Košice and their city districts. Bratislava has 17 city districts and Košice has 22 city districts. Participatory budgeting was first used in 2011 by the city of Bratislava. Since then, it has been applied by only more than 60 local self-governments. This means that only 2.08% of local self-governments have implemented participatory budgeting in their budgets (this percentage represents active and currently inactive participatory budgeting).

Table 1 Current use of participatory budgeting in the conditions of territorial self-government of Slovakia

Implementation since	Participatory budgeting in regional self-government	Participatory budgeting in local self-government
Since 2014	-	Bratislava-Nové Mesto, Banská Bystrica
Since 2015	-	Šaľa
Since 2016	-	Trnava, Liptovský Mikuláš, Piešťany, Partizánske, Poltár
Since 2017	Trenčín Region	Nové Mesto nad Váhom, Prievidza, Spišská Belá, Topoľčany, Bratislava-Rusovce, Bratislava-Vajnory, Bratislava-Vrakuňa, Kežmarok, Rožňava
Since 2018	Bratislava Region	Hlohovec, Nitra, Žabokreky, Poniky, Sološnica
Since 2019	Žilina Region, Trnava Region	Svidník, Trebišov
Since 2020	-	Bánovce nad Bebravou, Hnúšťa, Hrušín, Humenné, Jelšava, Levice, Martin, Nová Baňa, Púchov, Rimavská Sobota, Rovinka, Snina, Stará Turá

Source: Ministry of the Interior of the Slovak Republic 2020 [9]

Table 1 shows active participatory budgeting in the conditions of regional and local self-government. However, because of the Covid-19 pandemic, many participatory budgets have been canceled or suspended

until the situation will be stabilized. Examples are Trenčín Region, Žilina region and cities such as Trnava and Piešťany. Some participatory budgets were implemented in 2020. Examples are Trnava region, Hlohovec, Nitra, Nové Zámky, Senica.

2.2 Participatory budgeting in largest cities of Slovakia

There are currently 141 towns in Slovakia (municipalities with the status of a town). The five largest cities include: Bratislava (the Capital of Slovakia), Košice, Prešov, Žilina, Banská Bystrica (cities are ranked according to the number of inhabitants.). The current state of use of participatory budgeting is summarized in Table 2.

Table 2 Current use of participatory budgeting in the five largest cities in Slovakia

City (region)	Inhabitants of the city (2020)	Year	Allocated funds
Bratislava (Bratislava Region)	440 948	2011	15 000*
		2012	30 000
		2013	46 000
		2014	46 000
		2015 (CB)	36 000
		2016 (CB)	50 000
		2017 (CB)	50 000
		2018 (CB)	50 000
		2019 (CB)	50 000
		2020 (CB)	50 000
Košice (Košice Region)	238 138	-	-
Prešov (Prešov Region)	87 886	-	-
Žilina (Žilina Region)	80 386	2019**	-
Banská Bystrica (Banská Bystrica Region)	77 719	2014	19 455
		2015	19 343
		2016	20 000
		2017	30 000
		2018	40 000
		2019	40 000
		2020	40 000
		2021	40 000

Source: Self-elaboration (according to official websites and documents of the cities) [10] [11] [12]

*The first year. Funds obtained by the city from sponsors, not allocated from the budget.

**The City of Žilina has approved a general regulation determining the rules of the participatory budget.

Only two cities in Slovakia are divided into city districts (city wards). It's Bratislava and Košice. They are governed by the Mayor and the City Council, and each district (ward) also has its own elected council and council leader. Košice has no experience with participatory budgeting, but some city districts have it (for example: Košice - Západ, Košice - Sídliisko KVP and Košice nad Jazerom.). Bratislava uses it in practice, but we also find it in practice of some districts such as: Bratislava - Nové mesto, Bratislava - Lamač, Bratislava Rusovce, Bratislava Vajnory, Bratislava - Vrakuňa.

Bratislava is a leader in the implementation of this concept in Slovakia. It was the second European capital with a

participatory budget. In the years 2015 to 2020, Bratislava transformed participatory budgeting into a "civic budget". The reason for the change of name was to make it easier to understand and communicate to citizens. But in 2020, it canceled it (before the Covid-19 pandemic). The reason was the low interest of citizens. Table 2 shows that the only active participatory budgeting among the 5 largest cities in Slovakia is in the city of Banská Bystrica. In both cities, it is possible to see a gradual increase in the allocated funds. This is a positive trend. The city of Brno should be an inspiration (Brno invests approximately 1 180 053 euro).

3. Positives and negatives of participatory budgeting in Slovakia

Participatory budgeting is a modern phenomenon in the conditions of both levels of territorial self-government (local level and regional level) in Slovakia. The correctness of its use will be verified by several years of application practice. At present, the general positives of participatory budgeting have been confirmed. However, its application currently has many barriers, threats, and negatives.

The positives are:

- Innovative ideas and goals of projects.
- The submitted projects target (cover) areas that territorial units want to support in development (such as culture, leisure activities, sports, environment, transport, and social assistance, etc.).
- Participatory budgeting promotes democracy, civic activity, and public awareness of territorial self-government budgets.
- Freedom to choose a participatory budgeting model.
- Participatory budgeting is an option, not an obligation.

Identified negatives and threats:

- Annual victory of monothematic projects.
- Support for projects that benefit only a small group of people.
- Poor awareness of the population about participatory budgeting.
- Growing apathy, low interest of the inhabitants in public issues.
- Transfer, in the worst case, the release of responsibility for development by local or regional government representatives to activists.
- There is no legislation in the area of participatory budgeting.
- Lack of staff to ensure the whole process.
- Low budget for projects.
- Weak assistance in project implementation.
- Problems with voting (low turnout, fraud in electronic voting).
- Not visible result of implemented projects. This fact does not support the final phase of the process, which is evaluation and effective public control.

- For a relatively long time, any manuals, methodologies, or advice on the topic of participatory budgeting were missing. The Ministry of the Interior of the Slovak Republic published the materials on its website in 2020. Representatives of local governments "went for advice" to local or regional self-governments with experience with this concept.

4. Conclusions

Participatory budgeting in the conditions of territorial self-government of Slovakia is only at the beginning of its implementation, but it can be successful. The advice for local and regional authorities is to focus on the benefits and learn from the disadvantages, barriers, or mistakes. To be inspired by examples of good practice from abroad. A good example is the functioning of participatory budgeting in the city of Brno. Its main advantages are employees working only on this agenda, a larger amount of funds, the implementation of ideas of individuals (city residents) under the direction of the city, etc. This is a good concept that can bring many benefits to territorial self-government. One of them is that the local government is closer to its inhabitants. However, it is important to implement it correctly to avoid any failure.

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MANDATORY AND OPTIONAL BODIES OF COMMERCIAL COMPANIES AND THEIR REGULATION IN THE LEGAL ORDER OF THE SLOVAK REPUBLIC

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Abstract: *The aim of the article is to analyze the issue of mandatory and optional bodies of commercial companies. We point out the importance of the institute of bodies of commercial companies for trade, economy and business not only in the Slovak Republic, but also in the European area. In this regard, we deal with the bodies of companies in general and the basic sources of the legislation, the differences within personal and capital companies. Related to this is the issue of the creation of these bodies for individual types of companies such as a public company, a limited partnership, a limited liability company and a joint stock company.*

Keywords: *Commercial companies, bodies of commercial companies, statutory body, mandatory bodies, optional bodies, creation of company bodies.*

1. Introduction

Unlike the more general topic of commercial law or companies, which is analyzed by a number of professional monographs in the Slovak Republic (SR) and of course abroad, the more specific and specialized topic of company bodies is devoted to much less publication space. The issues of the bodies of commercial companies are rather partially elaborated in individual chapters of professional publications focused on a more comprehensive analysis of commercial law issues. In this view, it is a paradox, as the legal regulation of company bodies and the related definitions of their legal scope and powers are strategic for the company and the optimally functioning market mechanism.

Recently, only a few specialized publications have comprehensively dealt with the area of company bodies in their own right, which is a pity for the legal community. Within the Slovak Republic, these were the authors Strapač, Ďuran, Romanová et al. (2013). In their monographs, they explained the most important legal institutes relating to the bodies of commercial companies, their development and changes. The relatively unique publication pointed out the stable aspects of the mentioned legal regulation, but also possible weaknesses.¹

From the specialized literature concerning the narrower area of the bodies of limited liability companies, it is necessary to mention the publications by the author Fekete, which also contain in parts a detailed analysis of mandatory and optional bodies of Ltd. including their previous development.² The individual parts of the monograph (Commercial Code Commentary) were focused primarily on the comprehensive regulation of commercial law, resp. trading companies from the authors

Patakyová, Ďurica, Blaha et al. They discussed the legal-theoretical area, but also the very important legal-application side of the issue of company bodies. The publication has been published in several editions in a row.³ For completeness, it is necessary to point out several professional monographs from reputable Slovak authors such as Mamojka (Fundamentals of Commercial Law, Commercial Law in the System of Slovak Law) and Suchož (Commercial Code and related regulations), as well as other authors.

2. Bodies of commercial companies in general

In legal theory, we encounter several definitions of a commercial company, and some authors believe that a uniform definition of a commercial company would not be concise and without a relevant expressive value. This is due to the fact that the legal forms of commercial companies have a number of different features and generally differ from previous historical developments.

According to the legal definition in the provisions of § 56 par. 1 of the Commercial Code, a business company is a legal entity established for the purpose of business. The legal provisions state that a commercial company is established for business purposes, but the exceptions are a limited liability company and a joint stock company, for which establishment for other purposes is permitted.⁴

An entrepreneur can also be a natural person or a legal entity. The advantages of commercial companies as legal entities are mainly that the amount of resources invested in the established commercial company increases the credibility of this legal entity and easier access to foreign financial resources, unlike a natural person who has a lower ability to obtain external, resp. foreign capital for

¹ STRAPACH, P. a kolektív : Orgány obchodných spoločností a družstvá, Bratislava: Eurounion, spol. s r. o., 2013, p. 17 – 20

² FEKETE, I., Obchodná spoločnosť s ručením obmedzeným. Komplexná príručka., Bratislava : Epos, 2004 ISBN 80-8057-584-3, p. 392

³ PATAKYOVÁ, M. a kol. : Obchodný zákonník. Komentár. 3. vydanie, Praha : C. H. Beck, 2010, s. 13

⁴ STRAPACH, P. a kolektív : Orgány obchodných spoločností a družstvá, Bratislava : Eurounion, spol. s r. o., 2013, p. 21

business development. It is important to realize that in the case of commercial companies, only the company enters into business relations and not the partners personally, which has a fundamental impact on their liability. In most cases, the partners do not guarantee all their assets, as in the case of liability of a natural person.

Bodies in personal companies are understood differently, where only partners and no one else are bodies of the company, and in capital companies, where third parties can also be members of bodies. We distinguish between the highest body of a business company - the general meeting, which are the partners who decide on the most important issues of the company. Furthermore, among the statutory body, which is an external procedure and at the same time it is a body entrusted with business management. Finally, we differentiate between a supervisory body, which can be an optional body (in the Slovak Republic, the law presupposes in the case of a limited liability company) or a mandatory body (mandatory in a joint-stock company).

Thus, two categories of company bodies follow from the above - mandatory, which are obligatorily created and optional, which are created voluntarily. The statutory body is, of course, always the mandatory body. It should be added that the shareholders may also create a body that is not known to the Commercial Code, but the shareholders may not interfere with the powers of the bodies provided for by law.

2.1 Proceedings on behalf of a company

A commercial company expresses its legal capacity to have rights and obligations through a statutory body and, to a limited extent, through its employees or members, and the conduct of these entities is considered to be the personal conduct of the legal person, ie the company, and not its representatives. Within the conduct of a company as a legal entity, we can distinguish between direct conduct of a company through a statutory body and indirect conduct of a company through its representative.

The term legal representation of a commercial company means the creation of the right to act on behalf of the commercial company as a legal entity as a result of a legal fact other than the demonstration of the expression of the will of the principal. The legal representation of the company is specified in the provisions of § 13 par. 5 of the Commercial Code, which states that the head of an organizational unit of an enterprise or the head of an enterprise of a foreign person who is registered in the Commercial Register is authorized on behalf of the entrepreneur to perform all legal acts concerning this organizational unit or enterprise. Furthermore, the provisions of § 15 par. 1 of the Commercial Code and § 16 of the Commercial Code, which contains the legal regulation of the conduct of another person in the establishment of the entrepreneur.

Pursuant to the provisions of Section 15 of the Commercial Code, who was entrusted with a certain

activity during the operation of the company is authorized to perform all acts that usually occur during this activity. If a person's actions exceed the scope of the authorization pursuant to paragraph 1, the entrepreneur shall be obliged to do so only if the third party did not know about the exceeding of the scope of the authorization and, taking into account all the circumstances of the case, could not even know. Authorization to act according to § 15 par. 1 is therefore not based on the determination of the relevant acts in the internal organizational regulations, but on the authorization to perform a certain activity and to perform acts usually connected with this activity.

Pursuant to the provisions of § 16 of the Commercial Code, the entrepreneur is also obliged to act by another person in his establishment, if the third party could not know that the acting person is not entitled to do so. In assessing this legal representation of the entrepreneur, it is necessary to conclude with certainty whether the acting person is entrusted by the entrepreneur for a certain activity or whether he acts in his establishment and his authority to act can not be inferred alternatively.⁵

A commercial company can be represented in legal acts by a natural or legal person, while in the case of representation of a business company on the basis of a power of attorney agreement, we distinguish between representation by general power of attorney and probation. Representation of a company is also possible by a decision of a state body, as the court may also appoint a guardian to a person who is not known to stay, if this is necessary to protect his interests or if the public interest so requires. Under the same conditions, the court may appoint a guardian even if it is necessary for another serious reason.⁶

3. Statutory body of a commercial company

Commercial companies are characterized by bodies that are intended to facilitate the organization of business activities of several people. Their position or definition differs in the case of partnerships and capital companies. It should be emphasized that the internal structure is one of the basic features not only of the company but also of the legal entity as such and at the same time a condition for its existence. For this purpose, the law or the contract on the establishment of a legal entity directly enshrines the internal structure and creates the so-called company authorities. The absence of an internal organization, ie the company's bodies, is one of the reasons for the dissolution of the company in accordance with the provisions of § 68 para. 6 letter a) of the Commercial Code.⁷

The bodies of a legal person, unlike the legal person itself, do not have legal personality and the persons who are their members or participate in their proceedings do not act independently, but act on behalf of the legal person. A

⁵ Judgment of the Supreme Court of the Czech Republic, no. k. 23 Cdo 28/2008

⁶ § 29 of the Civil Code

⁷ STRAPÁČ, P. a kolektív : Orgány obchodných spoločností a družstiev, Bratislava : Eurounion, spol. s r. o., 2013, p. 151

body of a commercial company can be defined as an internal department without legal personality, which consists of a certain person or group of persons providing the company's activities, as a legal person, either in relation to third parties or within the company.⁸

A statutory body is absolutely necessary in a commercial company, because without it the company cannot carry out the activity on which it was established. According to the general definition in the Civil Code, legal acts of a legal entity in all matters are performed by those who are authorized to do so by the agreement on the establishment of a legal entity, the charter or the law (statutory bodies).⁹ "The statutory body of a legal person is the person who can act indefinitely on behalf of the legal person and thus express his will externally. We are talking about the so-called the existence of a general management authority on the basis of which those persons are authorized to perform legal acts on behalf of the legal person."¹⁰

A specific statutory body is determined for individual legal forms of commercial companies by the Commercial Code. The term statutory body, which in accordance with § 20 par. 1 of the Civil Code is taken over by the Commercial Code in accordance with the provisions of § 13 par. 1 and 2, as regards their right to act externally on behalf of the company, specifying for each type of company the designation of the statutory body, defines its essence as a collective or individual body, or leaves this question to the will of the shareholders, e.g. in a limited liability company and dispositively establishes the manner of acting on behalf of the company, individually or jointly, by at least two.

The Commercial Code complements the authority of statutory bodies, beyond their definition in the Civil Code, for individual types of commercial companies and cooperatives with competence in the matter of creating the will of the company. This scope is referred to as the business management of a legal entity and is related to decision-making in matters of corporate governance. The statutory body of an entrepreneur can be individual or collective, both in the creation of the will of the company, ie decision-making, as well as in the expression of this will externally, ie in proceedings. The determination of the course of action must be unambiguous, even if it follows from the substance of the case. The recordable method of acting on behalf of the registered legal entity is either to act independently or to act jointly by two, in the case of three managers, or members of the Board of Directors, etc. Or a combination, e.g. Chairman of the Board of Directors and Member of the Board of Directors. By action we mean the performance of legal acts, both formal and informal, in all matters. For the sake of completeness, it should be noted that the creation of the function of a statutory body

is conditioned by the establishment of the company itself. Acts performed by persons who, under the articles of association, are designated as statutory bodies and will become them on the day of registration are subject to a special legal regime.¹¹

4. Mandatory and optional bodies for individual types of commercial companies

A public company is a classic personal company, which historically belongs to the oldest forms of trading companies. Companions associate primarily with regard to their individual personal qualities, the decisive function is not to concentrate capital, but to combine human individualities with specific personality qualities to achieve common business goals.

Pursuant to the provisions of § 76 of the Commercial Code, a public company is a company in which at least two persons do business under a common business name and are liable for the company's liabilities jointly and severally with all their assets. It can be deduced from the legal characteristic that this company is a legal entity that can only be established for the purpose of business.¹²

According to the provisions of § 85 of the Commercial Code, the statutory body of a public company is each of the partners, unless the articles of association stipulate that they act jointly. If only certain shareholders are authorized to act on behalf of the company in all its matters by the partnership agreement, only these shareholders are its statutory body. The statutory body is the only mandatory body of a public company whose existence is given ex lege, and this does not only mean the legal obligation to create it, as is the case with capital companies. In this case, the law goes much deeper when it also determines ex lege the composition of this body, which is absent in the case of capital companies. Likewise, the Commercial Code does not entrust any specific competence to the statutory body, with the exception of the competence to act on behalf of the company in all matters.¹³

The determination that the statutory body in a public company is each of the partners is an expression of the applied monocratic principle. The articles of association may stipulate that they act jointly, but the articles of association may also stipulate that if only some of the partners act on behalf of the company, then only those partners are a statutory body. One of the differences between personal and capital companies is visible here, where in the case of capital companies the function of the statutory body can also be entrusted to persons who do not have a share in the company. In the case of a public trading company, it is "a priori" entrusted exclusively to a partner in the Slovak Republic. The Commercial Code

⁸ DEDIČ, J. a kolektív : Obchodný zákonník s podrobným komentárom pre právnu a podnikateľskú prax, Bratislava : Práca, 1996, p. 115

⁹ § 20 of the Civil Code

¹⁰ STRAPÁČ, P. a kolektív : Orgány obchodných spoločností a družstva, Bratislava : Eurounion, spol. s r. o., 2013, p. 88

¹¹ PATAKYOVÁ, M. a kol. : Obchodný zákonník. Komentár. 3. vydanie, Praha : C. H. Beck, 2010, p. 38 - 40

¹² SUCHOŽA, J. a kol. 2007. Obchodný zákonník a súvisiace predpisy Komentár, Bratislava: Eurounion, 2007, p. 227

¹³ STRAPÁČ, P. a kolektív : Orgány obchodných spoločností a družstva, Bratislava : Eurounion, 2013, p. 52

does not contain a provision that would explicitly deal with other bodies of a public company, the possibility of their creation, with the exception of the mentioned statutory body (§ 85).

It is necessary to distinguish the management of a public company from the statutory body. According to the provisions of § 81 par. 1 of the Commercial Code, each partner is entitled to commercial management separately, within the principles agreed in advance. If it has been agreed in the articles of association that only one or more partners will be entrusted with the management of the business, the other authorizations shall lose their authority to this extent. The authorized shareholder is obliged to follow the decision of the shareholders made by a majority of votes.¹⁴

A limited partnership is considered to be a personal commercial company with elements of a capital company.¹⁵ The legal regulation is in the provisions of § 93 - § 103 of the Commercial Code, according to which a limited partnership is a commercial company in which one or more partners are liable for the company's liabilities up to the amount of their unpaid deposit entered in the commercial register (limited partners) and one or more partners with all their property (general partners).¹⁶

The provisions on a limited partnership only name one body of the company, namely the statutory body, which is mandatory, resp. compulsorily created. Pursuant to the provisions of § 101 of the Commercial Code, the statutory bodies are limited partners, while each of the limited partners is entitled to perform the powers of the statutory body independently, unless otherwise provided by the articles of association. The decisive criterion defining the statutory body is the partnership agreement. The creation of the first statute is related to the establishment of the company and the subsequent change of the partnership agreement. The articles of association may specify how the limited partners shall exercise their powers, that is to say, whether they will be exercised by all, or only one, or some of them, or whether, in the case of several, they will act jointly or separately. In the absence of explicit regulation, all limited partners are the statutory body and each of them acts independently.¹⁷

According to the provisions of § 97 par. 1 to 3 of the Commercial Code, the general partner is therefore granted, in addition to the right to act as a statutory body of the limited partnership, also the main role in the management, resp. on the business management of the company. The term business management is not defined in the law, but refers to the internal affairs of the business entity and does not include the right to act on behalf of the company.

The limited liability company regulated in § 105 - § 153 of the Commercial Code, together with a joint-stock company pursuant to § 154 - 220a of the Commercial Code, is classified by legal theory among the so-called capital companies, which are characterized by the participation of shareholders in the form of provided capital, the separation of shareholders' assets from the company's assets and the low risk of shareholders' liability for the company's liabilities. A limited liability company fulfills this definition only with the difference that, compared to ordinary capital companies, it assumes a higher degree of personal participation of the partners in the life and activities of the company.¹⁸

In the case of a limited liability company, the bodies are created directly by the founders in the articles of association. The Commercial Code (§ 125 to § 140) defines mandatory and optional bodies. The general meeting of shareholders and one or more managers are mandatory bodies, for which it follows the need to establish them. If stipulated in the deed of incorporation or the articles of association, the supervisory board is also a body of the company, which is an optional body formed on the basis of the articles of association and has a controlling function. If the Supervisory Board has not been established, its function will be performed by the shareholders through the General Meeting.¹⁹

According to the Commercial Code, a joint-stock company creates three mandatory bodies: the General Meeting, the Executive Board and the Supervisory Board. In addition to the mandatory ones, the joint-stock company may also create other bodies whose position needs to be regulated in the company's articles of association (eg internal controller, general director, legal representation of the branch manager or head of another form of organizational unit registered in the commercial register, etc.). Mandatory authorities do not form a single unit. The difference stems from the different functions of these bodies and their composition and membership conditions. The General Meeting consists of the company's shareholders, who participate in its management. The Board of Directors is a statutory body and the Supervisory Board is a control body. Although the optional bodies are not explicitly regulated, the legal regulation allows their creation or establishment. In such a case, however, the competences and powers, the number of members and the manner in which they are appointed, must be clearly defined in the internal statutes.²⁰

The Board of Directors as a statutory body is obligatorily created in a dualistic concept of a joint-stock company, which is typical for the legal regulation in the Slovak

¹⁴ § 81 par. 1 of the Commercial Code

¹⁵ PATAKYOVÁ, M. a kol. : Obchodný zákonník. Komentár. 3. vydanie, Praha : C . H. Beck, 2010, p. 294

¹⁶ § 93 of the Commercial Code

¹⁷ STRAPÁČ, P. a kolektív : Orgány obchodných spoločností a družstva, Bratislava : Eurounion, 2013, p. 89

¹⁸ FEKETE, I.: Obchodná spoločnosť s ručením obmedzeným Komplexná príručka, Bratislava: Epos, 2004, p. 20

¹⁹ STRAPÁČ, P. a kolektív : Orgány obchodných spoločností a družstva, Bratislava : Eurounion, 2013, p. 152

²⁰ DVOŘÁK, T. : Akciová spoločnosť a Európska spoločnosť. 2. vydanie, Praha: ASPI, 2009, p. 385

Republic.²¹ The Executive Board is entitled to act on behalf of the company in all matters. The Executive Board can be an individual or collective body, while the exact number of members of the Executive Board is not specified by law, but is left to the articles of association. It is necessary to specify the exact number of the board of directors in the articles of association due to practical issues in the election of the members of this body.²²

Possibilities of creating optional bodies with regard to e.g. for combination with the functions of other bodies of the company, if they are not prohibited by the provisions of the law, as well as the definition of their scope are essentially unrestricted. However, this causes problems in application practice. In the proceedings of the CEO for a joint-stock company, the company is expected to have a wide range of legal representation. The limits of the scope of this type of legal representation are determined in the provisions of the Civil Code, which stipulates that the act of such a legal representative must relate to the subject of activity of the legal person. A similar issue is the legal representation of the head of the branch plant, or the head of another form of organizational unit registered in the Commercial Register, whose managerial authority is not limited externally.

5. Conclusion

Commercial company bodies are a current topic in legal theory as well as application practice. As far as the statutory bodies of commercial companies are concerned, the regulation is contained in both mandatory and a number of dispositional provisions. This provides sufficient scope for the variability of their scope, as well as the rights and obligations of the company's statutory body, although always within the legal boundaries created by mandatory provisions. An important source is also the rich case law of the Supreme Court of the Slovak Republic and, from the point of view of assessing the bodies of companies in the Slovak Republic, also the case law of the historically and legally closest Supreme Court of the Czech Republic.

In this context, we must state that legal theory deals mainly with the statutory bodies of capital companies, which is a consequence of the more frequent occurrence of capital forms of companies. Overall, statutory bodies have relatively sufficient legislation and are also more broadly elaborated in legal theory. The opposite is true of personal companies, which in Slovak legal conditions have essentially a brief and general definition, which does not always help practical business through these forms of companies. This is a consequence of less use of personal companies in business relations. The question arises as to whether a broader treatment of this issue would help to make more frequent use of the institutes of personal commercial companies.

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²¹ ŠTENGLOVÁ, I., DEDIČ, J., TOMSA, M. : Základy obchodného práva. Vysokoškolská učebnice, Praha : Leges s. r. o., 2014, p. 327

²² STRAPÁČ, P. a kolektív : Orgány obchodných spoločností a družstva, Bratislava : Eurounion, 2013, p. 290

COMPARISON OF INDIVIDUAL SYSTEMS OF PROVIDING SOCIAL SERVICES AND ITS FINANCING IN SELECTED COUNTRIES OF THE EUROPEAN UNION

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Abstract: Social services are important part of the functioning of an advanced society. Their operation is conditioned by the quality organization of human resources and equipment, which represents a considerable cost of their operation. Therefore we will focus on financing of social services, especially the provision of long-term care by comparing the systems of three European countries – Slovak Republic, Czech Republic and Germany.

Keywords: *social services, long - term care, financing*

Introduction

Social services represent a significant part of the social system, which excels in its diversity and at the same time demanding way of both operation and financing. As the population ages, several European countries have begun to see the provision of social services as an equal topic with previously preferred issues such as unemployment rates or social insurance. Each country is involved in providing several types of social services to help the disadvantaged, the abused, the dependent person and many more. However, the above-mentioned problem, the phenomenon of dependence on the care of the elderly, is gaining more and more attention. As this is a serious problem in terms of the necessary volume of provision of health and social care, as well as the financing of the services, this issue draws attention to the importance of the whole sphere of social services.

As the social sphere in the European Union is not harmonized, countries have their own specific social system. We will discuss some illustrative examples in the form of a description of the systems of EU countries, namely the Slovak Republic, the Czech Republic and Germany with a focus on long-term care listed below.

1. Slovak Republic

The development of social services in Slovakia has gone through several challenging periods in the past and it faces several partners in the form of coverage of all necessary services that will be urgently treated by the population in the present. Currently, the provision of social services is focused on the following activities (in accordance with the Social Services Act): crisis intervention, support for families with children, addressing an unfavorable social situation (due to severe disability, unfavorable health status, due to reaching retirement age), using telecommunications technologies and support services.

In connection with this issue, it should be noted that the mentioned services are provided to the persons in close cooperation with health care services, which is described

in more detail in Act no. 580/2004 Coll. on health insurance. [1]

Social services in Slovakia are provided by 2 types of providers - public and non-public. A public provider is an entity established by a municipality or higher territorial unit, compared to a non-public provider (performing activities for profit) has the opportunity to obtain resources from the payment of economically justified costs associated with social services, support from the founder (municipality or higher self-government). The non-public provider is defined as an "external" service provider, business person. [2] The motivation of these two entities is also different. While a public provider is an entity that is to be directed by a municipality or higher territorial unit to serve the well-being of the population regardless of profit, a non-public provider is a private person who is mostly interested in providing a service that generates a positive economic result with the highest possible profit.

The Ministry of Labor, Social Affairs and Family also provides a financial contribution for social services in facilities with conditional dependency for the municipality that has established, founded or provides social services in facilities: supported housing facilities, facilities for the elderly, care services facilities, rehabilitation center, social services homes and daily hospital. [3]

Setting a price of social services is a closely related topic to funding itself. There are also two different ways of pricing in this issue - different from public and private providers.

The public service provider determines the amount of payment for social services, as well as the method of its determination and payment agreed in the contract in accordance with the general regulation of the municipality or higher territorial unit. The municipality or higher territorial unit shall ensure that the average amount of payment for social services required by the public provider from the recipients of this service in accordance with the

concluded contracts is after recalculation of this payment to the recipient of the service per month or to another unit. In the case of providing selected services (assistance in personal child care, supported housing facilities, for the elderly, nursing services, rehabilitation center, social services home, specialized facility, day hospital and nursing service), the recipient of social services is obliged to make payment for the above services on the due date. The cost depends on clients assets and income.

The assessment of the income of the person in question is performed according to the special rules of Act no. 447/2008 Coll. on cash benefits to compensation for serious health insurance. [4]

2. Czech republic

The management of social services in the Czech Republic is slightly different from the system in Slovakia. Social care, specifically long-term care, is jointly administered by the Ministry of Health of the Czech Republic and the Ministry of Labor and Social Affairs. Each of them has its own quality criteria, legislation, accessibility and way of financing. In the social area, the Czech Republic follows a program called "National Strategy for the Development of Social Services for 2016 - 2025", which defines the basic objectives and measures for the period 2016 - 2025, according to which the system provides cash and in-kind benefits (social service). [5]

Unlike the Slovak system, the Czech Republic has taken the issue a little more forcefully - a care allowance (financially graduated according to the degree of dependency) has been introduced, which the person concerned can use to pay a service provider that suits him (whether a professional carer, his family or establishment). This method puts the dependent person in the role of a client, which caused a real fight for a customer on the part of providers and facilities in the Czech Republic. The investment amounted to a subsidy of € 635 million, which is not a small amount of funding, but the system appears to be very efficient.

"This financial benefit will suppress the dependent person in the role of a customer who chooses the service as best he can for his needs. Since the introduction of the new system in 2006, Czech social service providers have started a real fight for a client holding a bundle of money in their hands.." („Táto finančná dávka potlačí odkázanú osobu do roly zákazníka, ktorý si vyberá službu čo najlepšie jeho potrebám. Od zavedenia nového systému v roku 2006 začali českí poskytovatelia sociálnych služieb reálny boj o klienta, ktorý v rukách drží balíček peňazí.“) [6]

From the point of view of the centralisation of organisation of long-term care, the setting is established in a local and central form. The government of a specific locality is responsible for the development of social services provision and for regional networks creations. The municipality is also obliged to provide social services and

other forms of assistance to person without access to social services and person whose life or health is endangered. The provided support can cover both immediate and longer-term needs. Voluntary long-term care insurance is not possible. The Czech system distinguishes 2 types of providers: professional and non-professional. Professional providers are registered social services (legal entities established by regional and local authorities or private organizations, NGOs and individuals who provide services to the client at home, in institutions or as outpatient services.) Informal caregivers are family members, relatives and social care assistants. According to the performed analyzes of the mentioned National Strategy for the Development of Services for the years 2016-2025, it was found that the wages of social workers were significantly below the average wage in the country, which posed a serious threat to the willingness to provide social services. [7]

In the case of benefits, a distinction is made between a benefit in kind and a financial benefit, where a benefit in kind means e.g. providing the facility in which the client is located. However, it should be noted here that the person concerned does not have the possibility to swap the volume of these 2 types of benefits, however, it can be combined. [8] Based on the above, we can observe that the Czech Republic in the financing of social services, specifically long-term care for the use of state resources, support from regional authorities as well as possible co-financing by the clients themselves.

3. Germany

Germany approaches the issue of long-term care differently than Slovakia and the Czech Republic. In this country, great emphasis is placed on long-term care risk insurance, established in 1995 and currently operating as a separate and compulsory social security system. Long-term care insurance is enshrined in the Social Security Code. Funds corresponding to a contribution point of 0.1 have been allocated to the long-term care insurance fund managed by the Bundesbank since 2015. For them, the contribution rate is set to stabilize from 2035, when the baby boomer generation reaches the age group with a high probability of care. [9]

Every citizen also has the opportunity to conclude private supplementary insurance contracts before the need for care arises. The conclusion of a contract on voluntary private supplementary insurance is subsidized by the state since 2013. There are established uniform procedural rules concerning state subsidies for the provision of private long-term care, which private insurance companies must comply with. Furthermore, company-wide general insurance conditions for state-supported supplementary long-term care insurance have been established and approved by the Ministry of Health.

Long-term care insurance consists of two independent parts - social and private long-term care insurance, established as compulsory insurance between which there

is no income sharing, with the exception of the statutory financial compensation within these two insurance branches. The country has remade the insurance system almost to perfection, resulting in the fact that almost the entire population is covered by insurance through one of two compulsory insurance schemes. [10]

The German social system also thinks of people who are unable to work, are entitled to benefits, need care that they cannot help themselves and do not receive the necessary help from other people. These citizens are entitled to "care assistance" financed by population taxes.

Germany has also decided to go the way of decentralizing the provision of social services. The federal states are responsible for infrastructure planning and support. As in the case of Slovakia and the Czech Republic, social services are provided by professional providers and informal carers.

4. Comparison of financial and social setting

Creating an image of social conditions in the case of long-term care can be quite challenging. For this reason, we offer an overview of some data that can help us compare the financial and social settings of Slovakia, Czech Republic and Germany below (on page number 4).

Conclusions

The above table provides us an overview of the basic attributes of the countries socio-economic conditions. In comparison with the retirement age, the Czech Republic has the lowest age legally enshrined, and subsequently we focused on the minimum pension and monthly state contributions for the provision of long-term care. As we can see, Germany has its system set up differently from Slovakia and the Czech Republic, but in the case of long-term care support, both the Czech Republic and Germany focus on supporting home care, which confirms setting higher support than in residential or outpatient services. In the case of sharing the costs of social services, we can state that each of these countries has a certain rescue system even for cases that citizens would not be able to pay without state intervention. We included the average wage in the overview due to the simpler projection of unit labor, which could be approximately in the amount of the average wage. However, if we realize that the average wage is in any case higher than subsidies from the state, it is very likely that there are 2 types of situations in the social sphere - either social workers work for significantly lower wages than the average or it is necessary to co-finance the provision of social services. from various sources (state or private funds of the client). None of the above options is positive, so the way of risk insurance is an interesting way to solve the problem elegantly.

Based on the description of the functioning of individual countries, it can be stated that the financing of social services can be quite diverse even in the European area. In

addition to funding from the state budget, local governments, support from European Union grant programs and recipients of social services, we were significantly approached by the possibility of adding insurance for individual risks. Private insurance companies in Slovakia, as well as in several EU countries, provide various types of pension insurance, but such risks have not yet been launched on the market. Germany's long-term application of this system proves that it can be functional and sustainable in the long term, even in periods which, from the point of view of long-term care, will be a relatively difficult test for several European countries.

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Table 1: Comparison of financial and social Setting in Slovakia, Czech republic and Germany

	Slovak Republic	Czech Republic	Germany
Legal retirement age	From 1 January 2020, retirement age is based on the year of birth, sex and number of children raised with a maximum retirement age of 64 for both men and women. It also depends on average life expectancy until 2030. On 1 January 2021, the retirement age is 62 years and 8 months for men and women without children, born in May 1958.	Men: 63 years and 10 months. Women: depends upon the number of children raised: (no children: 63 years and 10 months; 1 child: 62 years and 8 months; 2 children: 61 years and 8 months; 3 or 4 children: 60 years and 8 months; 5 or more children: 59 years and 8 months) The legal retirement age for men is gradually being raised by 2 months each year until it has reached 65 years. The legal retirement age for women is increased by 6 months each year until it equals that of men. After that, the increase will also be 2 months per year until it has reached 65 years.	67 years (standard retirement age). The standard retirement age will be gradually increased to 67 years from 2012 to 2031, starting with those born in 1947. The first increase amounts to one month per year (65 to 66) and the following increase to two months per year (66 to 67). For all those born after 1963, the standard retirement age of 67 years shall apply.
Minimum pension	1. pillar: The amount of minimum pension varies from a minimum of 334.30 € when reaching at least 30 qualified years of insurance (personal earnings point in the relevant year has a value at least 0.241) to a maximum of 630.70 € when reaching 80 and more qualified years of insurance. The minimum pension is non means-tested. 2. pillar: no statutory minimum pension.	No statutory minimum pension. Basic Amount: Basic flat-rate pension (10% of monthly average wage) of CZK 3,550 (135 €) per month. Percentage Amount: CZK 770 (29 €) per month. The minimum (basic) pension is not means-tested.	No statutory minimum pension.
Monthly state contributions to the provision of long - term care	Residential care: The level of care: 2: 125 € 3: 280 € 4: 374 € 5: 530 € 6: 654 € Ambulant care: The level of care: 2: 83 € 3: 187 € 4: 353 € 5: 436 €	Care Allowance provided to persons over 18 years of age (per month): Grade I: CZK 880 (34 €) Grade II: CZK 4,400 (168 €) Grade III: CZK 8,800 (335 €) for people using residential care and CZK 12,800 (488 €) for people not using residential care Grade IV: CZK 13,200 (503 €) for people using residential care and CZK 19,200 (731 €) for people not using residential care Care Allowance is increased by CZK 2,000 (76 €) per month when recipients are dependent children under 18, or parents of dependent children under 18 living in families with an income under 2.0 times the family Living Minimum There are no limits to the duration of these benefits.	Home and semi-residential care: The level of care: 2: 689 € 3: 1 298 € 4: 1 612 € 5: 1 995 € Residential care: The level of care: 2: 770 € 3: 1 262 € 4: 1 775 € 5: 2 005 € If the person in need of care provides the care themselves, he or she can receive a care allowance (to ensure adequate support for body care and other care support measures such as domestic help. The monthly amount of this benefit is: The level of care: 2.: 316 €; 3.: 545 €; 4.: 728 €; 5.: 901 €
Cost sharing	The recipient of benefits in kind must pay the cost of services during the stay in the establishment according to his income and assets, but he must remain a certain minimum income (25% of the subsistence minimum per month). In the case of home care services, the recipient must be left with at least 165% of the subsistence minimum. Income considered to determine the level of cost sharing does not include one-off state social benefits, child allowances, tax bonuses, scholarships, etc. Assets are not taken into account if they are below a certain value.	Recipients of benefits in kind are obliged to contribute to the costs of meals and accommodation in residential social services. The limit for the contribution on board is 170 CZK (6 €) and the limit for the accommodation allowance is 210 CZK (8 €) per day. In addition, no cost sharing. After paying for food and accommodation, users must have at least 15% of income left in 4 types of residential care and 25% in semi-residential facilities. If the income remains below 15% (residential care) or 25% (semi-residential care), the amount of the allowance will be reduced below the minimum level according to the income of the person concerned. The spouse, parents or children can cover the difference between the required amount and the user's income. If they do not agree to cover the difference (4roce their free choice), the state will pay the difference. There are no exceptional categories of recipients who pay less.	Care benefits contribute to alleviating the physical, mental and financial burdens arising from the need for long-term care. Not all care costs are covered; only cash benefits and benefits in kind mentioned above. If the total cost of long-term care for one person exceeds the amount covered, the person will pay the difference as a share. In this 4roces, care allowances are the same for all those who need full long-term institutional care in care categories 2 to 5 in a care facility. In addition, patients have to bear their own living costs (accommodation, food, investment costs / maintenance). In the case of a financial need for assistance, the social assistance fund contributes to the costs of care.
Average wage for 2020	1 133 €	35 611 Kč (e. g. 1 401, 84 €)	4 035 €
Possibility of long-term care risk insurance	no	no	yes

References: [11], [12], [13], [14], [15]

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ENERGIC AND ENVIRONMENTAL ASPECTS OF RES FOR INDUSTRIAL BUSINESSES IN SYNERGY WITH THEIR INNOVATION POTENTIAL

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Abstract: Life of mankind on planet Earth is based on needs and fulfilling the consumption and energetic needs thereof. With the continuous development in regards to those needs, the demand for the energetic quantity is constantly increasing. The supply of a critical volume of energies is today secured by the so-called conventional energy sources (CES) – fossil or nuclear. However, the living environment is being extensively damaged beyond repair by processing and burning those fuels, which is the main reason why this way of energy production is not the most appropriate for the sustainability and, in fact, survival of life on Earth. If the demand of this age is to cover our needs by mostly burning fossil fuels, then we won't be able to avoid the critical and irreparable increase of ecological issues. The use of renewable energy sources (RES) is becoming the modern phenomenon to pave a way into energy consumption savings and save the natural environment in the long-term. The intention and basis of this report is to map a chosen energy and environmental aspects, evaluate and present the opportunities of innovation potential of RES in a chosen industrial business segment with the aim on small to medium enterprises and present an own working synergy model for these factors in conditions of an industrial business example towards their solution for energy basis

Keywords: innovation potential, power industry, ecology, innovation, renewable energy source

1. Introduction

The goal of energetics today is to find a such ecologically clear, energetically friendly and safe solutions, that will secure a persistent sustainability and energy supply for the ever-increasing consumption, economic effectivity and portability/networks and wirings, as well as power supply stability, clean environment, decreasing past environmental burden, compatibility with the other intertwined human activities and accessibility for the differently developed regions simultaneously. [16] There are many more or less preferred environmental topics such as: Energy policy of EU and SR, Renewable sources and their advancements until 2030 or even 2050, Environmental and energetic connections and impacts on a modern product society, Energetics audits, Integrated designing in context of energy quality improvement, etc. Those are also followed by projecting and building of prospective power sources with a high efficiency and other large-scale scientific topics which are required in order to get progressively acquainted with the theme to study and prepare a report. [9] Energy business goes beyond all the rational arguments for environmental optimization and negatively affects the smart developing trends and projects due to their interests. [1] Therefore it is definitely important to set the future businessmen and industrial companies for an inner belief that thinking ecologically and energetically effective means to think into the future and in regards of one's own survival, searching a concrete

and simple partial solution for the new renewable energy sources application and changing the attitude towards the environment by lowering the economic costs and efforts to secure a consistent sustainability. [2]

This is how one could view the interconnectedness of energetics with ecology by means of innovations. Intentional and innovational ability in business means [3, 7] elastic reaction to market's demand, quick realization of changes and adjustment of goals and conditions which always allow the introduction of technologies, economically effective and ecologically acceptable energetics economy into production. This is also a guarantee of a successful business in the future. [15]

2. Energetics, ecology, environmentalism, innovations, consistent sustainability and their competency

Energetics – energetics is a scientific discipline, which is focused on an efficient usage of all sources and source inventory and also industrial segment delivering the power. [6] The task of energetics is to solve technical, economic and ecologic problems along with harvesting the energy from natural sources and its exchange into usable forms, including the transport and energy storage. [20] The biggest challenge for mankind today is to find a such ecologically clear, energetically friendly and safe solutions, that will secure a persistent sustainability and energy supply for the ever-increasing consumption,

economic effectivity and portability/networks and wirings, as well as power supply stability, clean environment, decreasing past environmental burden, compatibility with the other intertwined human activities and accessibility for the differently developed regions simultaneously. For the better understanding of authors' approach toward the topic, it is necessary to know some of the key terms:

Environmentalism – a scientific discipline focusing on protecting and creating an environment as well as creating a personality and relationship between humans and living environment under the influence of such an environment. The terms ecology, environmentalism and environment are synergic, mutually intertwined and inseparable, therefore an understanding and solving of those terms is existentially important for humans. [4]

Innovation – literal translation from Latin means “renewal” [18]. Today there are more than 200 different definitions of this term, which all bear the same semblance [5], application of a new idea, change/improvement, new idea, invention. European commission (Green Paper on Innovation, 2004) understands innovation as a synonym for a successful production, assimilation, and usage of novelty in the economic and social sphere for covering a demand created by society and individual needs. [14] Then a term Innovativity is perceived as a renewability, introduction of new knowledge and solution into an existing system which allows an increased value to be reached, improvement, or if you want, newly created status [23]. The founder of the innovations theory J. A. Schumpeter once said: “Innovation is a practical transfer of ideas into new products, processes, systems and societal relationships”, as stated in [24].

Renewable energy source (RES) – is a source, whose energetic potential is continuously being renewed by natural processes or human activity and is distinguished by its overall potential, that is a renewable source power, which could be turned into different forms of power in a year and whose capacity is set by nature's conditions. Basically, it is a factor that is constant from short-term and also mid-term; it contains a technical potential, thus part of a cumulative potential, which is usable after an introduction of an accessible technology. We can also speak about usable potential, which could be explained as a technical potential lowered by legislative barriers and infrastructure that is not built yet. [9]

Innovation potential – is an adequate characteristics of an existing innovation environment in a given innovation dimension and a demonstration of the ability to function in an environment, where the innovations are created, continuously fulfilled and fostered. [17] This potential, in its synergy and connection with an internal innovative capacity and vitality of a given industrial subject in RES implementation, creates tools and operating measurements even when wide-spectrum and complicated solutions are involved in order to enable a practical and dynamic usage

mainly by industrial and production-focused companies from the segment of small to medium businesses. [19]

3. Industrial use of res, current status, positions and trends – critical commentary

Policy in the area of energetics: according to the newest available scientific knowledge and a need to increase the global precautions regarding climate, the European commission is approving a goal, which is to achieve that the EU is climatically neutral from 2050 in accordance with the goals of Parisian agreement. This transformation to climatically neutrality will bring along significant opportunities, for example in the field of economic growth, new business models and markets, new jobs and technology development. The key role falls to the policies in the area of research, development and innovations focused on the future and new energetic sources. [7,11,12] Trends on the market and industry: modern solutions of energetic industrial productions based on RES are connected to the application of one, or a combination of various RES, mainly biomass, geothermal energy and thermal, water and sea energy, solar and photovoltaic power, concentrated solar and thermal power, solar heating and cooling, wind power. As a matter of fact, there are no existing (except some experimental solutions for small customer sites) functional energetic economies based only on RES, but those are in all cases an advisable combination of those sources with the conventional sources of energies (CES) such as electric power plant/heating plant running on gas, coal, atom and oil products – fossil fuels, which are still essential for the stability and security of electric power supply and heat mostly in the industrially developed countries and whose exceptionally high consumption cannot be today covered by RES and even in long-term perspective with a significant (more than 50%) volume. [7,8,9,10] This is a key outcome and a knowledge for conception of any meaningful RES solution and application. Until 2030 will the orientational trajectory achieve at least the planned contribution of a membership country. The concrete orientational RES trajectory for Slovakia starts with a 14% value already in 2020. Tab 1 describes the estimated RES trajectories in our country until 2030.

Table 1: Estimated RES trajectories [3, 14]

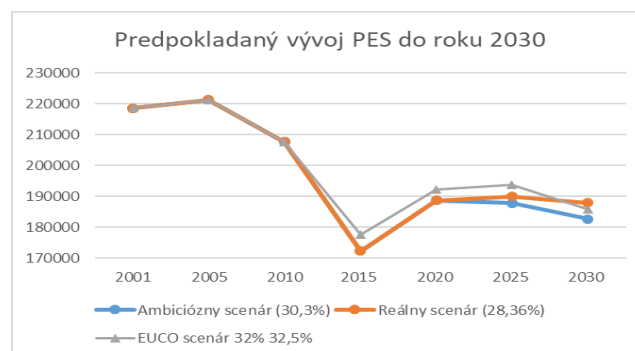
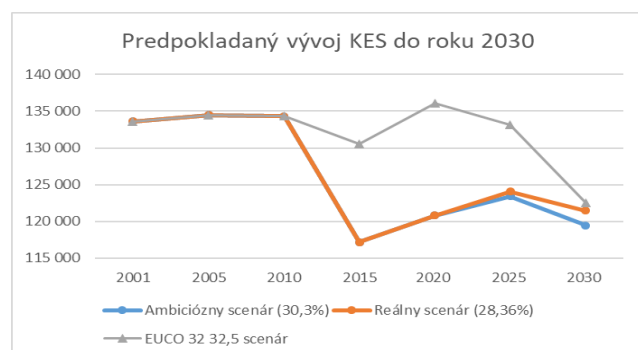
Years 20....	21	22	23	24	25	26	27	28	29	30
% RES – production of heat and coolness	13,0	14,3	14,6	15,2	16,1	16,7	17,5	18,1	18,5	19,0
% RES – production of electricity	22,4	23,4	23,9	24,4	24,8	25,9	26,4	26,7	27,0	27,3
% RES – transportation and distribution including multiplication	8,3	8,5	8,6	8,7	9,0	9,5	10,1	10,9	12,6	14,2
% Aggregated RES ratio	14,0	15,0	15,4	15,8	16,4	17,1	17,8	18,2	18,7	19,2

The problematic year seems to be the first control year 2022, where an exceptional increase is shown in contrast to the anticipation for 2020 and 2021. For the year 2020 there is a risk that the binding goal of 15% won't be fulfilled. In the area of RES, according to our interim analyses, the overall investment severity in reaching the RES area goals will reach 4,3 mil. Eur for 19,2% ratio. In terms of the RES framework an indicative goal is set in a form of orientational value of 1,3 percentual point as the yearly average for the periods of 2021-2025 and 2026-2030. The shown orientational value is lowered by 1,1 percentage point if the heat and coolness waste is not used. Orientational values reach the average yearly level 1,3% and 1,4%. We consider the reaching of increased growth or cumulative heat consumption in the industrial technology processes as very problematic from the standpoint of the yearly installation and exchange of equipment using RES. [7,10,11,12,22]

3.1 Supporting actions for energetic efficiency in sr

According to the orientational national contribution in the area of energetic efficiency in reaching the energetic efficiency goals of the Union, the Slovak Republic created two scenarios – realistic and ambitious. A study in the original language (Štúdiá nízkouhlíkového rastu pre Slovensko: Implementácia Rámca politiky EÚ v oblasti klímy a energetiky do roku 2030) was used in creation of those two scenarios as a base source. Coming from the current development of energy consumption and considering also the prognosed main characteristics influencing the consumption development until 2030, it is possible to say, that reaching the goal on 32,5% level until 2030 is very optimistic for Slovakia. [7,12] If it comes to the primary energetic consumption, its development in years 2012-2016 was non-uniform with the alterations of growth and decrease. In 2017 its value rose dramatically in comparison with 2016, likewise with CES. Realistic scenario assumes that in case of an unchanged trend of primary power consumption after 2020 it will be necessary to save circa 900 GWh yearly in order to reach the goal. In the case of an ambitious scenario, this value is even higher. [16] This indicates, similarly to the case of absolute power consumption, much higher demands for financing against the status as it was in the previous program period [9], as documented on pictures 1 and 2.

Figure 1 and 2: Development prognosis of accumulated power consumption (CES) and development of primary power consumption (PES) until 2030 (in GWh) [6,7]



Real measurements in order to support the energetic efficiency (Tab 2) in the industry for the long period of 2021-2050 are a combination of validated actions and activities from the Slovak action plans for energetic efficiency from the period before 2020 and newly proposed actions and activities at least until 2030. New measurement ideas reflect the need of SR to increase the pace at which the energy savings are reached in the industry, while stemming from the other countries' experience where they were proven to be very effective. [10, 11, 13]

Table 2: Supporting measurements for energetics efficiency [9, 10]

1.	Additional increase of energetic efficiency in the industry and industrial processes on top of modelled scenario framework.
2.	Introducing the circular economy and innovations into the industrial processes, for example usage of hydrogen as an innovative technology (including the switch to steel production based on hydrogen in case of sufficient hydrogen supply), including the compliance to Findings about BAT („best available techniques“).
3.	Innovate the energetically and materially demanding businesses in the industry area.
4.	Transfer to the new, clearer ways of power production and products also via using the energy sources without the greenhouse gas emissions in the industry or implementing the principles of circular economy.
5.	Lowering the usage of fossil fuels in the industry under the condition that it is technically and economically effective and this solution brings a real emission saving.
6.	Capturing and using all the thermal waste from the industrial and energetic processes in an efficient, cost saving way.
7.	Adjustment of the financial supporting mechanisms from EU and SR by means that those will be able to finance as much as possible of decarbonating measurements and measurements lowering the energetic severity, including the administrative burden along the project submissions.
8.	Including the fulfillment of Parisian agreement into the basic enactments in the international trading agreements between EU and third countries (tzv. „Paris clause“).

9.	Transformation shouldn't endanger the competitiveness of industry. Therefore, it is necessary to introduce a supporting measurement for the third country product importers into EU as for EU product exporters from EU to third countries. As a supporting measure for the product importers Slovak Republic supports the introduction of a customs duty for import according to the carbon footprint (so-called carbon border adjustment/tax), while it is also required to solve the measurements for keeping the exporters' competitiveness.
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3.2 Risks of res implementation

Generally speaking, the market barriers still affect the companies and consumers in all RES types, such as missing long-term stable conditions for the companies in regards to produced electricity purchases, non-existent systemic measurements for residents and only minimal investment stimuli for companies. Then there are technological barriers, where a use of all the complex RES is not currently possible, because many devices are significantly expensive and produced abroad, while the biggest starting market costs today still occur in photovoltaics (minimally twice as much as other RES). [11,12,22] Then there are informational barriers, nurturing people to use and meaning of RES and legislative barriers and concepts for using RES in full-area and big numbers, as also the credit system and financing the projects and RES building. Establishment, running and operating RES in Slovakia is controlled by additional special legal enactment (in original language – Zákon o podpore OZE a vysokoúčinnnej kombinovanej výroby č. 309/2009 Z. z. – 19.7.2009), which regulates the conditions, rights and duties for the RES producers, combined produce and high-effective combined electric power and heat production (Slovak abbreviation – KVEH) and manufacturers of biomethane, also sets the rights and duties for other participants on the market with electric power and gas, such as transmission grid operators. The following tab 3 describes the RES variations in Slovakia with their characteristics, common barriers, and possible potential according to processing of a widespread set of parameters, tables and analyses done by the authors of this report during the research. [11, 12, authors]

Table 3: Overview of RES variations in Slovakia [11,12]

RES type	Characteristics	Barriers	Potential
Biomass	In our conditions it is realistic to use the forest biomass for the energetic purposes, including energetic vegetation, agricultural biomass, waste from furniture and food industry and waste biomass from industry.	Unfamiliarity, distrust, information deficiency regarding the heating costs using this way, missing state support for those alternatives.	Covers 32% of overall represents a realistic energetic output in form of a heat and electric power. Potential circa 120 PJ and a means for regional and local economy development

Water energy – small and big water electric plants	Water power is the most used RES in Slovakia for the electric power production. During the long period of time using the energy improved the technological steps.	Higher investment costs, long period of return, inappropriate activities from interest associations, regulations in protected areas and flows.	Overall flow potential in Slovakia represents 13 679 GWh/year. Extensive part of water energy comes from small water flows, this is why it could be used only in small water electric plants with a capacity of <10MW.
Geothermal energy	Geothermal energy is becoming the second biggest RES in Slovakia. Slovakia has good conditions for development and usage of geothermal water energy. Based on research and survey, 25 prospective areas were allocated in the country with an accumulation of geothermal waters ranging in temperatures from 25 °C to 150 °C. Prevalent part of areas has the water temperatures eligible for the heating of industrial spaces.	Inefficient technology development, high investment costs and chemical composition of water.	In Slovakia, 38 localities are being used mainly for heating and recreation with a heat-utilizable power 142,75 MW which accounts for 2,6% from the overall geothermal energy potential in Slovakia.
Solar energy	The amount of solar energy falling on the SR area is approximately several times bigger than the current consumption of primary energy sources in this area. The amount of falling solar energy on the SR area is approximately 200 times bigger than the current consumption of primary energetic sources here.	Investmentally difficult storage, capture and exchange of energy.	Technologically usable potential of solar energy was officially stated by the Ministry of Economics to a level of 9,450 GWh/34,000 TJ yearly, which in Slovakia represents a second biggest technology potential after biomass. In a few years, the potential of solar energy overtook even the geothermal and water energy.
Wind	Acceptable conditions for using the air energy are in such localities, where the average yearly speed of wind is	Adverse effect on electric supply system stability, visual	Potential in SR is small, circa 2%. In 16,4% of the SR region are the average wind speeds >3,5m/s and in 2,369% of

energy	higher than 5m/s. From the viewpoint of adequate wind conditions, Slovakia has hardly any convenient areas and concrete localities.	environmental change, regulations in protected areas, knowledge deficiency.	region they are >4,5m/s.
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RES potential in Slovakia from the point of energy production is mostly related to monitoring the energetic severity attribute of modular buildings and operating and investment severity costs are detailly analyzed in [8, 11, 22]. They point out a prominent attribute – energetic security of heating and cooling, lighting and operation of electric devices, mainly technologic production of equipment, machines, and lines. Running energetic demands become the main indicator of a business' operation. Because their values could be affected in the very beginning phase of project creation, it is possible to extensively intervene [25] into the objects' structure, technologies and their operation and to modify the existing systems and knowledge with the new innovations. Description of the current status, energetic balance, choice of power sources with the preference of RES, then economic evaluation with the set investments return rate and definition of environmental burdens and sustainable development factors are the main chosen attributes for focusing on the innovations. [22] Authors of this report were therefore eager to dedicate themselves to this topic for a longer period and in detail.

4. Synergy of energetic and environmental res aspects in industrial businesses and their innovation potential

It concerns an important understanding of industrial behavior per industrial business, whose main goal is to produce goods or services with the highest possible economic effect (ergo the lowest manufacturing and operational costs along the highest revenues in a given time and area of coverage). However, the need to mind the energetic and environmental aspects in production is realistically unfavorable circumstance and a constraint, paradoxically it is also essential need for the growth of innovative potential and selling success on the market – synergy effect and joint cohesion without a choice to omit whichever of these aspects to make a business survive. This happens in the ever changing and competitive environment and also provides the industrial businesses an opportunity to search and implement the new innovations for securing this synergy. New professional requirements for industrial production and increasing expectations cause businesses to count on the change from conventional way of thinking to a more efficient means of governance. Nevertheless, if the essentiality of the need for change is not firmly set, it is not possible to set a goal and method of change execution. One of the most effective changes looks to be, according to these principles, fundamental management of the business productional, managerial, distributional, and operational processes. The switch to the

new ways of governance is enabled also via new innovative approaches and new informational technologies, which are a part of managerial informatics systems in a business. [21, 22] However, the base finding is a knowledge of wide range file of eligible diagnostic methods and audits, which have a sufficient actual value for the business and connect the innovation factors and attributes in regards of application of modern approach towards the energetics and environmental aspects of business governance. [4, 6] For understanding the basic connections of this synergy, the authors created their own working model on picture 3, which was and will be an object for deeper research in the area of modern energetic sources for the industry. This model steadily follows the existing auctorial outputs that were processed and published and the energetic effectivity of governing RES in the industry implementation model itself. [15, 17]

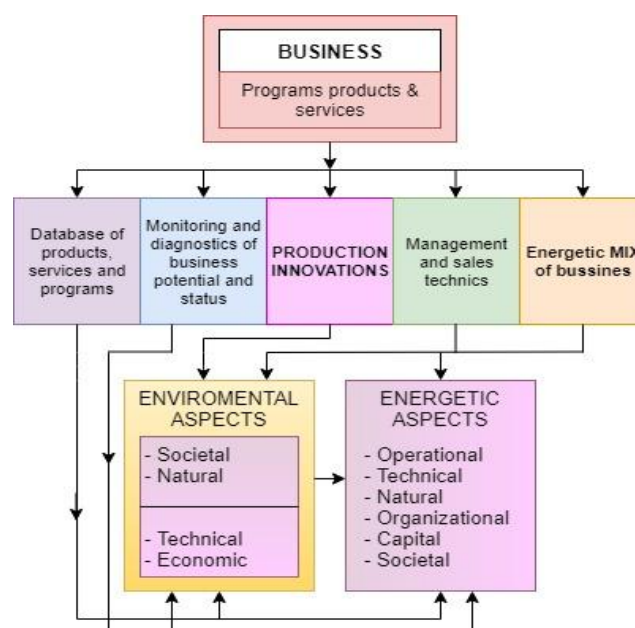


Figure 3: working synergy model of energetic and environmental res aspects towards the business innovation potential [15, 17, authors]

The given model specifies an industrial business as a file of processes that pursue the production as their priority, providing industrial services and related operational activities, which are split into five components:

- Database of products, services, and programs – tells about what is the industrial business producing, which technological background it covers and material-technical security, which services it secures for the rest of market subjects and how it appeals on the market [17],
- Monitoring and diagnostics of business potential and status – presents an actual status and level of business innovations per se, but also its process system management, monitoring and control of continuously received volumetric, qualitative, and economic results in production [17],

- c) Production innovations – a key component for a business with focus on steering, connected with its own innovation potential and position as a result of its individual abilities, creativity and competitiveness support against the other businesses on the relevant market. Nevertheless, innovation is a process (not an action, event, or occurrence) and as such it must be governed or managed. Factors, which could define this process, could be affected, and therefore also affect the result. It is valid that innovation potential contains inventional and innovational ability [24], therefore an elastic reaction towards the market demand, quick realization of changes and adjustment of goals and conditions, based on which it was executed; effective research. It could be stated that a decision making is a process of evaluation and innovation choice appropriate for fulfilling the strategic goal and governance repose on the innovation creation, which could change the current status.
- d) Management and sales technics – consists of ability of business to govern, control, and create the new products and use the new techniques and methods of sales, which highlight the energetic and ecologic effect and usage of products on the market, and mainly their creation in the production process, and also exerting the adequate public relations tools, ads and propagation for the evaluation of its products on the market and the given societal area,
- e) Energetic mix of business – represents the actual status of energetic sources, which are used in the business during production process and operation and restriction of current and future status individually usable RES and their ratio towards the CES (conventional energy source), securing the energy supply internally or via central distribution networks.

Consequently, the model shows how those components are existentially interconnected and have an impact on the environmental aspects – split into so-called general items such as societal and natural aspects (which business cannot directly influence and is forced to accept them) and also so-called expert items as technical and economic aspects (which business can influence significantly by own production). Additionally, it is an interconnection with the energetic aspects which are directly in a choice competence and application of business in production and those are operational, technical, natural, organizational, investment and societal components. [15] Given scheme shows the impact of a business on energetic and environmental aspects in relation to governance and innovations on one side as well as backward interconnection of aspects on business operation and its market position.

In managing energetic and environmental policy of industrial business with the explicit aim to improve its innovation potential is necessary to keep in view the given measures to support the energetic efficiency (described in tab 2) set by authors of this report with a choice of those

exact measurements, which are related to possible implementation in a concrete situation of a given business. At the same time the management needs to also observe the position development of a given energy and environmentalism bounded to development prognosis of the end consumption energetics (CES) and development of the primary energetics consumption (PES) as described on pictures 1 and 2, which could be very eminent among innovation parameters ranks in the business in the future. Authors approach this problematic with their own professional opinion as such – energetic and environmental aspects in the conditions of industrial business create impacts not only on their character and production capacity and related current innovation potential, but also are an impulse for their own innovational creativity inside the business in regards of changes and improvement of its energetic mix and operational approach.

5. Conclusions

Authors of this report are convinced that the constantly newly created possibilities and technologies in utilizing of alternative and renewable sources in today's world could cover 60-70% of energy which is required for the industry and societal consumption, therefore the efforts for searching the new knowledge about the massive use of RES in the industry and especially in a widespread group of small to medium enterprises accounting for 40% of production in SR and EU is very important provided the notably innovative approaches and implemented modern RES sources. Because of the accessibility of Earth resources (its biodiversity) it is necessary to secure a long-term and "everlasting" sustainable entrepreneurship, which refers to the societal effort in lowering the negative impacts on social, environmental, and economic areas. It could be a search of various indexes that directly or indirectly affect the business efficiency, including the extractive industry, which represents a base of industrial sectors in many countries. From the results it could be interpreted that the business with Earth sources has many obstacles, which the society has to overcome in order to continuously sell the Earth sources for a favorable price. [2] Nevertheless, for the functioning of industrial businesses it is becoming critical to apply modern energetic and ecologic sources in order to secure production and service operation and for the increase of own innovation potential and competitiveness in the future. To do this, new synergy models of these factors need to be projected in the future towards the overall economy and empowerment of business innovation potential in the future.

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EXPLORING ENERGY INTENSITY AND PROCESS FEATURES IN MEMBRANE-ASSISTED OXYGEN PRODUCTION PROCESS

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Abstract: Oxygen is a necessary gas in many industries, it is mostly consumed in the metallurgical industry nowadays (approximately 55%), while another 25% of its production is consumed in the chemical industry. Oxygen is produced in large capacities, especially by the cryogenic separation method. Because processes are constantly developed and optimized to be as economical as possible, cryogenic separation can be supplemented with membrane pre-separation, where a membrane is placed in front of the compression section to ensure reduction in the energy intensity of the process. This is even more necessary in the current situation, as electricity prices are constantly rising. In this computational study, feasible operating conditions of a membrane module were examined. The results indicate that increasing the pressure of the permeate leads to a reduction in both the oxygen content and the power requirement. Operation conditions that ensure reduction of power consumption, compared to the basic unit layout without a membrane, comprise permeate pressure of above 0.15 bar coupled with oxygen molar fraction in permeate of at least 0.4. The achievable reduction in power consumption amounts to more than 20 kWh/t of oxygen produced compared to the basic design of the cryogenic unit. Its further reduction could be achieved using a four-stage compressor instead of the currently considered three-stage compressor.

Keywords: hybrid air separation, membrane, cryogenic air separation, compression

1. Introduction

Oxygen is a necessary utility and material in many industries. Most oxygen (approximately 55%) is consumed in the metallurgical industry while another 25% of its worldwide production is used in the chemical industry to produce ethylene glycol [1].

In May 1895, Carl von Linde, a German scientist and engineer, performed an experiment that led to his invention of the continuous process of air liquefaction based on the Joule-Thomson refrigeration effect and the principle of countercurrent heat exchange. This was one of the first milestones in cryogenic air separation [2].

The next big milestone was when Linde set the basis for the development of a double-column rectification system, which contributed to the simultaneous production of oxygen and nitrogen [2].

In addition to cryogenic air separation, also non-cryogenic technologies are used for air separation, such as membrane, adsorption, chemical process, and ion transport membrane processes [3]. To further optimize air separation, these technologies can be combined to lower energy consumption [4], which is very desirable due to the increasing price of electricity [5].

One of the most common combinations is membrane and cryogenic air separation. In this study, we focused on the membrane and compression sections of the process. Further analysis of membrane characteristics and the cryogenic separation column is a long-term goal.

1.1 Membrane processes

Membrane processes are based on different diffusion flows of components through the membrane. There are several properties of membranes, such as material, flux, specific area, pressure difference, and others to be considered. A constant of proportionality that varies with the type of membrane is called 'permeability'. Permeate is a mixture that passed through the membrane. Retentate is the residual mixture. Selectivity is the ratio of the permeabilities of separated gases. Due to the smaller size of the oxygen molecule, most membrane materials are more permeable to oxygen than to nitrogen [3].

Figure 1 shows a simple scheme of the membrane process, where orange circles represent nitrogen molecules, blue represent oxygen molecules, and yellow ones are water vapor molecules.

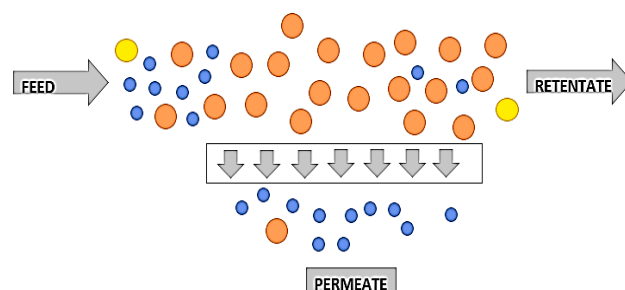


Figure 1: Scheme of the membrane process. Source: own elaboration

Membranes can be made from different materials. The best membranes for gas separation are polymeric membranes,

which are mostly organic but can also have an inorganic part. Polymeric membranes dominate in gas separation because of their well-established large-scale synthesis and the ability to adopt different configurations (spiral wound or hollow fiber). Nevertheless, polymeric membranes are also known for their trade-off limitations between permeability and selectivity. One of the goals of the ongoing research is the development of carbonized polymer precursors to produce carbon molecular sieve membranes (CMSM). This type of membranes should avoid this limitation [6].

1.2 Study Objectives

In a previous study [7], a cryogenic air separation unit system with a production of approximately 5.87 t/h of 95 % vol. oxygen was analyzed. This unit consisted of a compression section and a cryogenic separation section with two columns. Air was compressed in a double stage compressor with an intercooler and an aftercooler from 1 bar to 6 bars. Power consumption in the compression part was 1906.9 kW, so specific power consumption was 325 kWh/t of oxygen produced.

In the current study, the basic air separation unit was further modified with an additional membrane, fan, and an additional compression stage. The main goal was to determine the relationship between the permeate pressure and the mass fraction of oxygen in the permeate which ensures the same total power input for a triple-stage compressor and a fan as in [7], where a double-stage compressor was used.

The effect of permeate pressure on the mass flow of the permeate and retentate was also examined.

2. Materials and Methods

The proposed hybrid air separation unit is a combination of membrane pretreatment and cryogenic air separation, with the same cryogenic section design as in [7]. The modified part of the unit is presented in Figure 2.

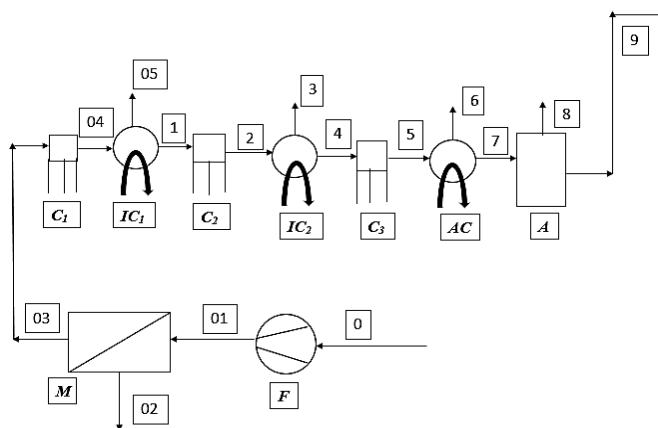


Figure 2: Scheme of modified compression section; A, adsorber, AC, aftercooler, F, fan, M, membrane; C₁, C₂, C₃ – compressor stages, IC₁, IC₂ – intercoolers. Source: own elaboration

Stream 0 is air drawn from the atmosphere, cleaned of dust and other impurities.

A fan is necessary to blow air into the membrane; pressure increase caused by the fan was 0.05 bar and the temperature increase exceeded 4 K. The fan power input as well as that of each compression stage is calculated by equation (1)

$$P_n = \frac{R \cdot T_0 \cdot \left(\frac{\dot{m}_G}{M_G} + \frac{\dot{m}_G \cdot \bar{Y}_0}{M_{H_2O}} \right) \cdot \frac{n}{n-1} \cdot \left(\beta^{\frac{n-1}{n}} - 1 \right)}{\eta_c} \quad (1)$$

where, R is the molar gas constant ($8.314 \text{ J} \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$), T_0 is air temperature at the inlet (K), \dot{m}_G is mass flow of dry air ($\text{kg} \cdot \text{h}^{-1}$), and \bar{Y}_0 is the equilibrium relative mass fraction of water vapor ($\text{kg} \cdot \text{kg}^{-1}$). M_G is molar mass of dry gas ($\text{kg} \cdot \text{mol}^{-1}$), M_{H_2O} is molar mass of water ($\text{kg} \cdot \text{mol}^{-1}$), β is the pressure ratio, n is the polytropic coefficient, and η_c is the overall compression efficiency.

The membrane considered in this study was made of phenolic resin material. Phenolic resins are very popular and inexpensive polymers used in a wide range of applications, from commercial construction materials to high-tech applications [8].

Stream 02 is retentate, which mainly contains nitrogen with the mass fraction of nitrogen of 90 % or even more. Stream 03 is permeate, which can contain up to 50% oxygen [9].

The mass fraction of oxygen in the permeate, w_{P,O_2} , is calculated by equation (2)

$$w_{P,O_2} = \frac{w_{R,O_2} \cdot \alpha}{(\alpha - 1) \cdot w_{R,O_2} + 1} \quad (1)$$

where α is selectivity and w_{R,O_2} is mass fraction of oxygen in retentate.

Selectivity, α , can be calculated by equation (3)

$$\alpha = \frac{P_{O_2}}{P_{N_2}} \quad (3)$$

where P_{O_2} is permeability of oxygen and P_{N_2} is permeability of nitrogen. Permeability of oxygen of the considered membrane [9] is equal to $3.1119 \text{ m}_n^3 \cdot (\text{m}^2 \cdot \text{hbar})^{-1}$ and that of nitrogen is $0.2922 \text{ m}_n^3 \cdot (\text{m}^2 \cdot \text{hbar})^{-1}$, thus the selectivity is 10.6.

It should be noted that membrane separation is considered efficient when the selectivity is higher than 4 [10].

The pressure of permeate can vary in the range of 0.1 – 0.29 bar [9]. The permeate is compressed in a triple-stage compressor to 6 bars. An intercooler is located behind each compressor stage to cool the air to 30 °C to ensure partial

condensation of water vapor contained in air already in the compression section and reduction of unit power consumption due to lower air temperature at each compression stage inlet.

Air leaving the aftercooler at 6 bars still contains a portion of water vapor which has to be removed before entering the cryogenic section. For this purpose, an adsorber is used.

Stream 9 represents dry air routed to the heat exchanger, which is a part of the cryogenic air section.

3. Results and Discussion

Total input of the triple-stage compressor and the fan is equal to 1906.9 kW, which was the power consumption of the compression section in its basic design as stated in [7]. Power input of the fan, 45.15 kW, was obtained from Equation (1). So, the total power of the compressor was 1861.75 kW, or 620.58 kW per compression stage, if equal power consumption distribution over stages is assumed.

As it results from Equation (1), compressor power depends on inlet air temperature, mass flow of dry air, mass flow of water vapor in air, and pressure ratio. Temperature at the compressor input is approximately the same as that at the membrane outlet. The mass flow of water vapor in the inlet air is 504 kg.h^{-1} . An analysis of Equation (1) yields the mass flow of permeate and the pressure ratio as the only variables.

Mass flow of dry air depends on the mass flow of permeate, which results from the material balance of membrane separation. Results of the membrane material balance are shown in Table 1.

Table 1: Material balance of the membrane

Permeate pressure [bar]	Mass flow of permeate [kg.h^{-1}]	Mass flow of retentate [kg.h^{-1}]
0.1	12 429	17 571
0.15	14 000	16 000
0.2	15 339	14 661
0.25	16 542	13 458
0.3	17 657	12 343

With the increasing permeate pressure, its mass flow also increases while the mass flow of retentate decreases. The results are also shown in Figure 3.

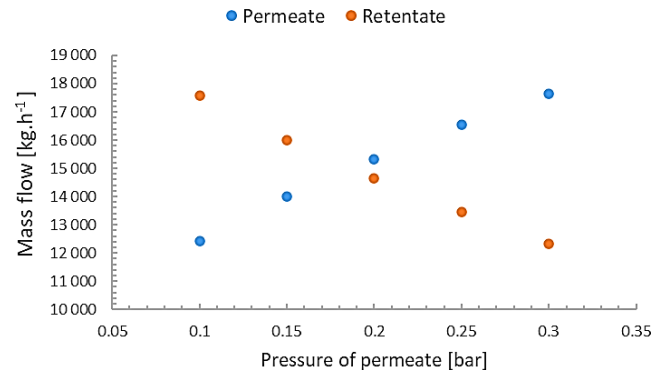


Figure 3: Mass flow of permeate and retentate as a function of permeate pressure

Mass flow of permeate is equal to that of retentate at the permeate pressure of 0.193 bar.

Another result of the material balance of the membrane is the mass fraction of oxygen in the permeate. The relationship between this fraction and the pressure of the permeate was analyzed and the results are shown in Figure 4, where also power consumption of compressors per ton of oxygen as a function of permeate pressure is presented. With the increasing pressure, both the power consumption and the oxygen content in the permeate decrease. Thus, it is necessary to find optimal permeate pressure to ensure that the compression is as economical as possible in terms of energy consumption and higher molar fraction of oxygen.

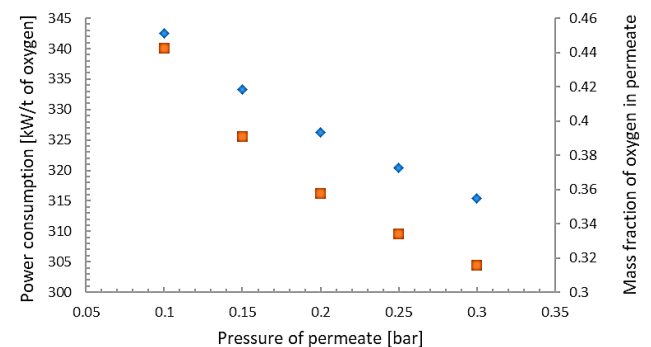


Figure 4: Mass fraction of oxygen in permeate (blue) and power consumption in compressor (orange) as a function of permeate pressure

Estimated specific power consumption in a simple cryogenic process was 325 kWh/t of oxygen produced in [7]. Figure 4 indicates that the compression work requirement is lower at the molar fraction of oxygen in the permeate of 0.4 or more and the permeate pressure of at least 0.15 bar.

Since air pressure after compression is set to 6 bars and the pressure of the permeate is variable, it is important to monitor the pressure ratio. The maximum allowable pressure ratio for a single compression stage is

approximately 7. The calculated pressure ratios are shown in Table 2.

Table 2: Pressure ratio per compression stage

Permeate pressure [bar]	Pressure ratio per one compression stage
0.1	3.915
0.15	3.420
0.2	3.107
0.25	2.884
0.3	2.714

It can be seen from Table 2 that the higher the permeate pressure at the membrane outlet, the lower the pressure ratio, and thus lower unit power required for air compression. However, as shown in Table 1, with the increasing permeate pressure, permeate mass flow also increases, leading to higher air flow through the compressor stages, which counteracts the effect of reduced pressure ratio to some extent. Pressure ratios of around 3 indicate that the currently considered three-stage compressor design with intercoolers can be modified to a four-stage design reducing thus unit compression energy input. The achievable reduction in power consumption must be weighed against the increased complexity of the system and the anticipated higher maintenance costs.

4. Conclusions

Energy-efficient oxygen production on a large scale is a matter of research and innovation activities throughout the world. The importance of reliable and low-cost oxygen supply was even more highlighted during the current COVID crisis. The presented study contributes to the research effort by exploring suitable operating conditions of a membrane-assisted oxygen production process, designed as a modification of a basic cryogenic air separation unit.

The results indicate that a reduction in energy consumption can be achieved in the compression section of the unit, compared to the basic cryogenic unit, at the permeate pressure of above 0.15 bar and the mass fraction of oxygen in the permeate exceeding 40 %. This ensures sufficient decrease of permeate mass flow to be further processed, thus outweighs the effect of the increased unit power consumption in the compression section resulting from permeate vacuum. Achievable reduction in the specific power consumption amounts to more than 20 kWh/t of oxygen produced, which represents a reduction of more than 6% compared to the basic cryogenic unit. A four-stage compressor design might further reduce the energy requirements compared to the three-stage design considered in the membrane-assisted oxygen production unit.

The authors' further work will address the issues related to the necessary operation change of the cryogenic part of the unit, as well as its possible redesign. Another interesting research extension that will be pursued is the comparison

of membrane-assisted and adsorption-assisted oxygen production.

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MATHEMATICAL MODEL FOR CALCULATION OF HEAT LOSSES FROM THE INTER-BLOCK STEAM PIPING IN A REFINERY

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Abstract: Calculation of minimum heat losses from a steam pipeline network to the ambient environment is critical for monitoring, control, and understanding of its operation as well as for prevention of excess losses. To develop such a calculation method, an internship focused on this issue was proposed by a refinery and was undertaken by a student with the supervision of several engineers. During this internship, the pipeline network was examined and a mathematical model was developed to calculate heat losses in real time. This model used a different approach than models used in the refinery so far to provide a different perspective. The model is based on the Fourier's law. Comparing heat losses obtained by other models used in the refinery, the new model proves to provide better assessment and more reliable prediction, including excess losses.

Keywords: mathematical model, heat losses, pipeline, refinery, steam

1. Introduction

Heat utilization efficiency is crucial for the economic efficiency of any industry, including a refinery [1]. It also has a positive impact on the environment as it reduces the amount of heat to be generated [2] as well as the associated greenhouse gas emissions [3]. One of the most important assets where significant heat losses are usually observed is the steam inter-block piping network [4]. In refineries, the length of such piping may reach tens or even hundreds of kilometers, resulting in a considerable surface area through which is the energy of steam lost into the atmosphere. For some refineries, heat losses from inter-block piping networks can be of greater importance than for other ones due to greater safety distance of individual blocks to prevent catching fire from one another. Longer safety distance can be found mainly in countries where fear of bombs was a major concern.

One of the crucial factors to prevent excessive heat loss from these pipelines is a good monitoring system [5], which is a great help to operators and engineers in identifying and preventing unnecessary heat loss. Mathematical models and approaches should support it to ensure the credibility and precision of such a system.

1.1 Enthalpy

Enthalpy of a thermodynamic system is defined as the sum of its internal energy and the product of its pressure and volume. This thermodynamic property is used in refineries as a relevant form of energy. Specific enthalpy of a material can be calculated when its temperature and pressure are known.

1.2 Heat Transfer Equation

The heat transfer equation provides the amount of heat transferred per unit of time using three parameters: 1. geometries of the material through which heat is transferred; 2. thermal resistance of the material; and 3.

temperature difference at the ends of the material, also known as the driving force. In case of a pipe, this includes the length, inner and outer diameters, thermal resistance of the pipe material, and the temperatures at the inner and outer walls of the pipe. A doubled temperature difference results in a doubled heat loss. The heat transfer equation is presented in Equations (1) and (2), where L represents the length of the pipe, D_1 and D_2 are its inner and outer diameter, respectively, and T_1 and T_2 are temperatures of the inner and outer walls of the pipe. A schematic depiction is provided in Figure 1.

$$\text{Heat Loss} = \text{Geometry} \cdot \frac{\text{Driving Force}}{\text{Resistance}} \quad (1)$$

$$\text{Heat Loss} = \frac{2\pi L}{\ln(D_2/D_1)} \cdot \frac{(T_1 - T_2)}{\text{Resistance}} \quad (2)$$

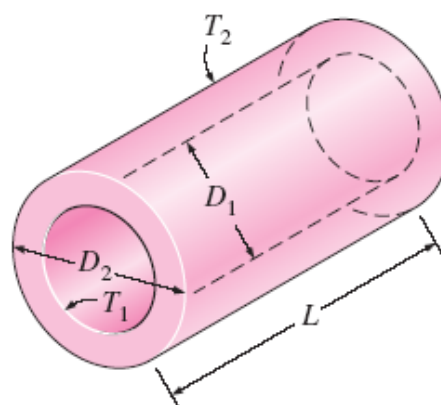


Figure 1: Schematic depiction of a pipeline segment. D – diameter, L – length, T – temperature. Source: own elaboration.

1.3 Study Objectives

The main objective of this work is to develop a mathematical model to calculate the heat losses of a given steam pipeline network. The model should be developed in such a way that it can also be applied to other piping networks.

2. Materials and Methods

Three main types of steam can be found in a refinery, distinguished by their pressure: 3.5 MPa steam, 1.0 MPa steam and 0.4 MPa steam. Piping network for each type of steam has its own technological scheme. Each steam has different condensation temperature. Saturated steam conditions should be avoided in pipelines and the transported steam temperature should always be kept above its condensing temperature [6]. Therefore, it is essential to create a mathematical model for one piping network, which can then be applied to the other two networks.

For this purpose, the 3.5 MPa steam pipe network was chosen because it is the most important and least complicated pipe system and has the most reliable measurement equipment installed. It is the most important system because it transports steam with the highest quality in terms of pressure and temperature. Temperature of this steam must be higher than 300 °C to prevent condensation of water vapor that could damage the pipes and the steam-consuming equipment (steam drives). Such a high temperature also increases the driving force of heat transfer, further highlighting the importance of a proper insulation.

Piping system for 0.4 MPa steam is used, among others, for steam tracing of high-density and high-viscosity materials. This makes it very difficult to measure and identify all the parameters that affect heat transfer in this system. Even if this were possible, the reliability of the results would be doubtful.

Obviously, heat losses from the steam pipelines were calculated in the refinery in the past, based on the difference in the enthalpies of steam exported from the combined heat and power unit of the refinery and the steam imported by individual production units. On its way out of the heating plant, steam loses some of its energy and this loss can be measured by temperature and pressure measurements. From a technical point of view, this is a very simple approach relying solely on measured values, and these heat losses are referred to as 'real losses' further in the text.

Since heat loss from the piping to the environment between the blocks is of great importance, it should be calculated by more than one method to ensure correctness of the results and to prevent the results being negatively affected by nonfunctional steam pressure and temperature metering equipment [7]. For this reason, a mathematical model based on a different approach was developed in this work. Heat loss through the pipe wall is calculated using

the heat transfer equation. It is important to note that these losses are the minimum losses of the given system and are referred to as 'minimum losses' further in the text, enabling to estimate how much heat is lost in excess (real losses - minimum losses = excess losses). Excess losses can be caused, for example, by damaged insulation [8] or by the aging of the pipeline network generally [9]. It is important to note that the refinery already calculates such minimum losses but uses a different mathematical approach based on constants and factors that depend on air temperature to calculate 'empiric minimum losses'.

A schematic of the 3.5MPa steam piping network was not available in digital format, and its length was not known or difficult to work with. Therefore, the lengths of all pipes had to be measured using ortho-parametrically adjusted satellite images imported into the digital scheme of technical bridges. The pipeline was visible in the image and was drawn into the plan. After the plan was completed, it was verified by personal inspection of the pipeline. This site visit included checking for damage to the pipes and their insulation, and verifying that all dilation expansion joints as well as vertical lengths of the pipeline were accurately calculated.

2.1 Mathematical Model

Dimensions of the pipe and insulation were assigned to the correspondent segments of the pipe network to meet the specifications of the documentation accordingly. The material (thermal resistance) was known and considered the same for all pipes and equipment. Insulation material was the same for the entire piping network. Thermal resistance of insulation was estimated by specialist engineers at the refinery as it was already aged.

The main assumptions of the model are as follows.

1. Heat transfer is a stationary transfer. This can be assumed because the steam temperature is stable.
2. The steam does not cause any resistance in heat transfer. This can be assumed because the heat resistance of steam is negligible.
3. Temperature of the outer surface of insulation is estimated. This estimate has minimal effect on the result, even if an error of 50 °C is made.

The pipeline network was divided into eight sections depending on the branching and diameter. For each section, steam temperature was calculated (it corresponds to the temperature at the inner wall of the pipe) as a weighted average of the measured temperatures in the given section. Temperatures were measured near the heating plant and at all battery limits. Steam temperature in a section was calculated as an arithmetic average without considering the location/distance of the measurement points. However, the temperatures must be weighted by the volumetric flow at the same measurement point to avoid using misleading temperatures at the battery limit of the disconnected block, which can reach very low values (e.g. 10 °C). This temperature was only observed for a

small branch leading to a shutdown block, where steam is stagnant (zero flow rate) and which is separated from the rest of the section by a valve. Therefore, this model requires online measurement of temperature and flow, and only points where these two parameters are measured can be used in the calculations.

Thermal resistance of air was calculated using a mixed coefficient for heat transfer by radiation and convection, and thus it depends on the temperature of the insulation surface which is in contact with air. To avoid iterative calculation, the insulation surface temperature was estimated to be between 0 and 40 °C throughout the year and constant for each month. Air temperature was measured online at the refinery.

The use of the just mentioned coefficient makes the calculation very simple but also inaccurate. It does not consider the effects of wind, rain, etc. It was decided to neglect these effects because they are very difficult to simulate and to measure. In addition, the pipe is usually located in a bundle of pipes, often also protected by a roof and walls, which reduces the effects of weather, but also makes measurement and calculation even more difficult. It can be assumed that the model is not suitable for rainy weather.

3. Results and Discussion

The presented mathematical model yields an online calculation of heat losses, which means that they change continuously. The same applies to real heat losses as well as to empirical minimal heat losses. Therefore, the averaged results are discussed further.

The values of minimum heat losses calculated with our mathematical model represent a fraction of real heat losses and were close to the values of the empirical minimum heat losses. This result was approved by most of the engineers interviewed. The model was also applied to historical temperature and flow data for the last ten years, and the results were compared with a database of heat losses for this time period kept at the refinery. This comparison proved the model to be generally suitable but significant discrepancies were observed for some periods. This could be further investigated with the prospect of obtaining interesting information on the pipeline operation in the mentioned periods.

An example of model comparison for 2016 is provided in Table 1.

Table 1: Comparison of losses calculated by the presented model (Minimum losses) and old model used in the refinery (Empiric minimum losses) for 2016.

2016	Empiric minimum losses [GJ]	Minimum losses [GJ]	Relative difference
Jan	10	5,230	54,750%
Feb	7,140	4,645	35%
Mar	3,174	3,777	19%
Apr	2,735	4,855	78%

May	4,813	4,823	0%
Jun	5,927	4,545	23%
Jul	5,479	4,570	17%
Aug	1,879	5,119	172%
Sep	5,023	4,903	2%
Oct	4,897	5,028	3%
Nov	727	5,125	605%
Dec	3,386	5,279	56%
Total	45,188	57,900	28%

Relative difference of 28% for 2016 is considered acceptable, taking into account that the new model was not adjusted to the results of the existing empiric model and was only compared after its completion. Nevertheless, different results of the models can be seen. The new model is very stable and shows similar results for each month. On the other hand, the existing model contains a few values that are almost zero. This suggests that the new model is insensitive to some stimuli or that the existing model did not yield reasonable results, especially in January, where the relative difference of 54,750% was observed. Overall, the models provide similar values that differ in certain periods because of unknown reasons. Such periods, including January, August and November 2016, should be investigated to elucidate the cause of the difference and to extract important information.

The presented model is also suitable for a sensitivity analysis by varying one of the parameters, e.g. the quality of the insulation which plays a crucial role in the heat losses calculation. The model can be used to estimate savings achievable by replacing insulation, which represents a direct and tangible benefit for the refinery.

4. Conclusions

A mathematical model was created and used to calculate heat losses to the environment from an inter-block pipeline network for 3.5MPa steam; it is also suitable for other steam pipeline networks. To evaluate the results of the model correctly, the user must know how the model works and what are the pros and cons of the applied assumptions as well as its flaws.

The model provides the value of minimal heat losses from the given pipeline network to the surroundings in real time. Comparing heat losses obtained by other models used in the refinery, the new model proves to provide better assessment and more reliable prediction, including excess losses.

Furthermore, minimal heat losses are divided into individual sections of the pipeline, which can be helpful when locating insulation failure or other damage to the pipeline.

The impact of insulation replacement can be calculated by adjusting the insulation parameters in the model.

Acknowledgements

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OPTIONS OF REDUCING THERMAL ENERGY AND WATER CONSUMPTION IN A SMALL ENTERPRISE

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Abstract: The world nowadays depends on efficient and sustainable use of its limited resources. It is therefore paramount to focus on energy efficiency in all industrial sectors. The small and medium-sized enterprises (SMEs) category represent an industrial sector where energy efficiency receives less attention than is desirable. In this study, initial results of a general energy management assessment of a small enterprise are shown. The general system layout is presented and a mathematical model of a single batch operation is introduced. Preliminary measurements as well as calculations are described in detail, including assumptions, reference states, and equation systems. Measurement outputs and key process energy indicators are presented in the results, with additional discussion focused on the economic and environmental impact of the proposed mitigation measures. Annual savings of 160 MWh in natural gas and 1700 m³ of water on a single washing machine are achievable, which corresponds to a 12% reduction in water and gas expenditure. Environmental evaluation yielded the corresponding annual reduction in the emissions of CO₂ of 130 tons.

Keywords: laundry, energy efficiency, energy management, carbon emissions

1. Introduction

Nowadays, in the time of climate change and with the growing demand for natural resources, a significant part of current research is aimed at reducing the consumption of several essential resources. The prime interest is the reduction of energy consumption and, in turn, the reduction of greenhouse gas emission. Another important point of interest is industrial water consumption. Small and medium enterprises (SMEs) represent a significant part of industry; however, this category of enterprises is often less intensely researched due to their heterogeneity. For example, in Sweden, SMEs represent 30% of industrial energy use [1]. The laundry industry (LI) is a significant consumer of water within the SMEs category, consuming as much as 15 liters of water per kilogram of processed laundry [2].

1.1 Energy Management

Generally, in the LI, the main component of total costs is the cost of energy and water supplies. To maintain competitiveness, LI businesses are forced to reduce these costs by efficient management of available resources. This can be achieved by optimization of the laundry process or application of energy efficiency equipment and measures, such as water recycling, wastewater heat reuse or solar power utilization [3]. The general aim and goal of this study, including this initial measurement, is:

- assessment of energy management in a small enterprise,
- identification of feasible energy efficiency measures,

- assessment of the impact of such measures on the environment.

1.2 Lindström s.r.o.

An initial measurement was carried out at a small enterprise (SE) - Lindström s.r.o. - focused on renting and laundry of workwear for various businesses and industries, and large mats for various public and private building entrances and interiors. The service includes renting of either workwear (WW) or mats and periodic replacement of dirty laundry. Naturally, the enterprise manages the logistics and transportation. In case of WW, the consumer only returns the WW and receives clean WW. In case of mats, the entire replacement of mats is managed by the enterprise [4].

2. Materials and Methods

Lindström operates eight laundry washing modules, with half of them specialized in washing mats and the other half in washing workwear. Mat-Specific Modules (MM) consist of two large capacity washing machines and a large capacity dryer. The drying program is much shorter than the washing program; therefore, one drying machine is enough to maintain a quasi-continuous drying operation while the washing machines are operated cyclically.

Figure 1 shows the configuration of one of the washing machines and related equipment. Mats are represented as dashed lines, whereas solid lines represent water and steam. A batch of seven dirty mats (stream no.6) is first loaded into one of the washing machines, washed, and

then unloaded (stream no.4) onto a large capacity tray, from which it is loaded into the dryer and dried. Once dry, it is unloaded and stored.

MMs number 1 and 2 are heated by medium pressure steam generated in a compact gas burner, which is a part of the module itself. MMs number 3 and 4 are also heated by medium-pressure steam generated in the nearby boiler room. In the first phase of energy management assessment, only MMs 3 and 4 were considered.

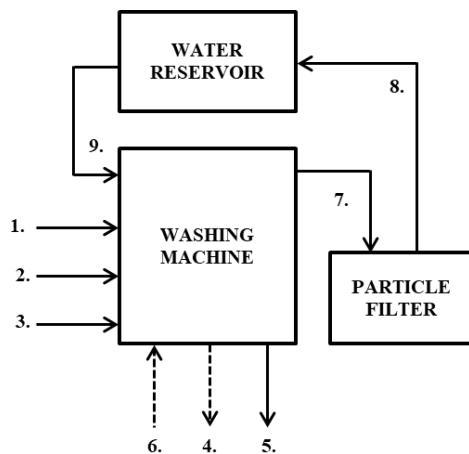


Figure 1: Scheme of the washing machine system; 1-9 material streams; 1 – CHTW, 2 – steam, 3 – detergent, 4 – clean mats, 5 – drain water, 6 – dirty mats, 7 – recycled water, 8 – filtered recycled water, 9 – feed recycled water

The most frequently used washing program consisting of two washes was examined. The first wash in the program uses recycled dirty water (RW) (stream no.9) from the last wash in the previous program, which is stored in a heated reservoir above the washing machines. After the first wash, dirty water (stream no.5) is directed to the site wastewater treatment plant (WWTP) and then released into the sewage. The second wash uses chemically treated water (CHTW) (stream no.1). Once the second wash is finished, the water is led through a filter (stream no.7), where dirt, fibers, sand, and other particulate matter is removed; and it is pumped (stream no.8) into the recycled water reservoir. Steam (stream no.2) is injected directly into the washing batch to heat the batch at the beginning of the program and to maintain the desired washing temperature during the program. A relatively small amount of detergent solution (stream no.3) is also added to each wash.

To assess energy management in the SE, several energy indicators which are not regularly monitored by the SE must be obtained. Therefore, a separate measurement was performed to obtain information about the amount of steam used in the washing program examined, to check the real usage of process resources and, should any discrepancy be found, to assess the potential of energy and water saving.

2.1 Measurement and mathematical model

For the preliminary measurement, piping of the washing machine was adjusted, namely the drain pipe and the recycled water pipe were redirected into 200 l cylindrical barrels. The measurement was performed two times. The amount of steam consumed during the washing cycle was calculated by an indirect method described in detail below. Let m_{in} be the mass of all inputs and m_{out} the mass of all outputs. The general mass balance can be expressed by Equation (1)

$$\sum m_{in} = \sum m_{out} \quad (1)$$

The total mass balance of the system can be expressed by Equation (2)

$$m_{feed} + m_{steam} + m_{detergent} = m_{drain} + m_{moisture} \quad (2)$$

Consequently, to obtain the mass of steam used in the program, other variables must be known or measured. The amount of feed water, m_{feed} , (either RW or CHTW) and the amount of detergent solution, $m_{detergent}$, are specified in the datasheet of the washing program. For the purposes of this measurement, the detergent solution was considered as pure water in further calculations. Therefore, the total amount of water drained from the washing machine and the amount of water trapped as moisture in the wet mats have to be measured. The amount of water in mats, $m_{moisture}$, was measured by differential mass measurement; the mats were weighed before and after the wash and, neglecting any dirt, sand, fibers or particulate matter in the dirty mats, the amount of water trapped in washed mats was calculated as the difference of these two values, as shown in Equation (3)

$$m_{moisture} = m_{mats;wet} - m_{mats;dirty} \quad (3)$$

Total amount of water drained from the washing program was measured volumetrically. The drained water was redirected into cylindrical barrels; water level was measured in each of the barrels and, assuming perfect cylindrical shape of the barrels, the volume of water in each barrel was calculated. Assuming the density of the washing mix to be equal to that of pure water at the same temperature, the mass of water in each barrel was calculated. The total amount of drained water was then calculated as the sum of the water mass in each barrel. Next, the enthalpy balance of the system is introduced and analyzed. Let h_{in} be the specific enthalpy of all inputs and h_{out} the specific enthalpy of all outputs. The general enthalpy balance can be expressed by Equation (4)

$$\sum h_{in}m_{in} = \sum h_{out}m_{out} \quad (4)$$

If zero heat loss is assumed from the washing machine to the environment, the total mass and enthalpy balance (MEB) of the first wash can be obtained; see Equations (5) and (6)

$$m_{RW} + m_{steam;1st w.} + m_{det.;1st w.} = m_{1st w.mix} \quad (5)$$

$$h_{RW}m_{RW} + h_{s;1st w.}m_{s;1st w.} + h_{det.;1st w.}m_{det.;1st w.} + h_{mats;cold}m_{mats} = h_{1st w.mix}m_{1st w.mix} + h_{mats;hot}m_{mats} + h_{moisture}m_{moisture} \quad (6)$$

Likewise, the total material and enthalpy balance of the second wash is shown in Equations (7) and (8)

$$m_{CHTW} + m_{steam;2nd w.} + m_{det.;2nd w.} = m_{2nd w.mix} \quad (7)$$

$$h_{CHTW}m_{CHTW} + h_{s;2nd w.}m_{s;2nd w.} + h_{det.;2nd w.}m_{det.;2nd w.} = h_{2nd w.mix}m_{2nd w.mix} \quad (8)$$

In the second wash, both the heat consumed to heat the mats and the moisture in them were neglected since their mass and temperature are the same at the beginning and at the end of the wash.

The next step is to determine the enthalpy of the materials. Reference state for water and steam is 0°C, 611Pa, liquid; therefore, specific enthalpies for water were obtained from [5]. Steam specific enthalpy is determined from the h-s diagram of water vapor [5]. If constant specific heat capacity of mats throughout the heating process is assumed, specific enthalpy of mats can be obtained from Equation (9)

$$h_{mats} = c_{p;mats}(t_{mats} - t_{mats;reference}) \quad (9)$$

where $c_{p;mats}$ is the specific heat capacity of mats. Specific heat capacity of a material consisting of several components can be obtained using Equation (10)

$$c_{p;material} = \sum c_{p;i}w_i \quad (10)$$

where $c_{p;i}$ is the specific heat capacity of the i-th component of the material and w_i is the mass fraction of the i-th component in the material.

Mats used by the SE are made from two components – nylon textile and durable rubber backing. Then, the specific heat capacity of mats can be determined using Equation (11)

$$c_{p;material} = c_{p;nylon}w_{nylon} + c_{p;rubber}w_{rubber} \quad (11)$$

where the specific heat capacities are obtained from [6].

3. Results and Discussion

First, the required measurement was carried out and output values were calculated (Table 1). At first, only the mass balance of the system was evaluated.

Table 1 Measurement results

First measurement	
$m_{mats;dirty}$ [kg]	80.9
$m_{mats;wet}$ [kg]	96.1
$m_{moisture}$ [kg]	15.2
m_{drain} [kg]	601.5
Second measurement	
$m_{mats;dirty}$ [kg]	76.8
$m_{mats;wet}$ [kg]	94.2
$m_{moisture}$ [kg]	17.4

m_{drain} [kg]	544.4
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By introducing MEB, the theoretical amount of consumed steam was determined. Then, the result of this first evaluation was used as a basis for MEB evaluation. Results of these calculations are shown in Table 2. At first glance, the amount of used steam calculated from the mass balance system was unusually high. Since this amount of water could not have been delivered into the system via direct steam heating, it was assumed that one of the input amounts was incorrect. Due to the negligible amount of detergent solution, the only reasonable explanation was that feed water dosing was higher than prescribed by the washing program.

Table 2 Washing program indicators

Theoretical values	
m_{steam} [kg]	15.3
m_{feed} [kg]	340
First measurement	
Mass balance evaluation	
m_{steam} [kg]	276.4
MEB evaluation	
m_{steam} [kg]	27.4
m_{feed} [kg]	589.0
Second measurement	
Mass balance evaluation	
m_{steam} [kg]	221.6
MEB evaluation	
m_{steam} [kg]	25.5
m_{feed} [kg]	533.8

Next, the real amount of recycled water and CHTW was determined using the MEB system with the measured results and mass balance as a basis. A considerable discrepancy between the theoretical amount of feed water and actual amount of used feed water was discovered. This means that both the amount of consumed CHTW and the amount of consumed steam in the process are nearly double compared to the values resulting from the washing program settings. This could be caused by incorrect regulation of the input pump, which is most likely based on the definition of the washing program itself. To mitigate this loss, consultation with the company responsible for the washing programs management is recommended to arrange a correction within the program itself.

Upon further economic evaluation, adapting correction measures and considering the best-case scenario, potential annual savings of 160 MWh in natural gas and 1700 m³ of water on a single washing machine are anticipated. When applied to both MMs, achievable savings represent 12% of total water and gas expenditure of the enterprise. Considering the CO₂ emission factor of natural gas of 0.2 t/MWh, a decrease in CO₂ emissions of 130 tons can be reached consequently. Generally, when speaking of SMEs, similar water usage optimization measures prove to be promising with low investment and high savings potential, as shown by Petek et al. [7].

Lindström s.r.o. is an eco-aware company with a significant focus on sustainability and as such is already taking measures to optimize the process using the presented data.

4. Conclusions

A significant amount of data relevant to general energy management at Lindström was obtained in the presented paper. The preliminary measurement led to a refinement of further measurement techniques and served as a starting point for further research at Lindström. The next step is to confirm the measured values using a refined method of measurement followed by measurements in additional modules, with boiler room efficiency analysis and, finally, with the evaluation and measurement of drying processes. Thereby a complex energy management assessment of the small enterprise analyzed was obtained, serving as a basis for the subsequent optimization of energy and media consumption.

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THE IMPLEMENTATION OF MONTE-CARLO SIMULATION INTO ENERGY TRADING PROCESSES

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Abstract: *Can we predict how the prices of energy commodities will change in the future? If we can, it would be a priceless tool for traders helping them to better manage their portfolio. In this article a research team combined from both academic and business environment examines one way to achieve this. Specifically it focuses on how to modify and use a mathematic method called Monte-Carlo simulation and combine it with the latest IT technology advancements in order to simulate the future development of the energy market. The first chapter provides a deeper perspective of the issue examined. The second chapter gives a deeper look on the Monte-Carlo simulation and how it could be beneficial for the issue at hand. The article then provides a practical test of the modular Monte-Carlo simulation on a model energy portfolio while using a standard server equipment. Based on the theory and test results article provides an extensive discussion focused on how the simulation could actually be used in a normal trading IT infrastructure.*

Keywords: *energy trading, Monte-Carlo simulation, energy market, ETRM systems*

1. Introduction

As a part of decision-making and control processes in energy commodities trading, it is necessary to evaluate various future situations and assumptions with an impact on the trading portfolio. The risk management departments responsible for the company's readiness for various market situations often face the task of analyzing the possible effects of market changes on the company's business portfolio.

The tasks, which a commodity trading company solves, can be divided into two basic areas:

- tasks aimed at analyzing and stressing the existing portfolio,
- tasks focused on the analysis of the internal methodology for the implementation of an open position or the company's behavior in the market.

The first group of tasks deals with the issue of revaluation of the current business relationships, where the company calculates various risk indicators and based on the results it can correct its position or relationship with business partners.

The second group of tasks is focused on the simulation of the methodology of opening and closing a business position, where the possible impact of selected strategies on risks that may affect the financial condition of the company is monitored.

Such tasks, for which it is not possible to say in advance how the market will develop, are solved by defining various development scenarios and then simulating the market environment and monitoring how the monitored indicator will develop.

Given that the market behavior is a largely stochastic process with a possible complicated calculation structure, methods are used which can simulate this market behavior. [5] The result of such a simulation is not a number from one market simulation, but a value derived from a statistically significant sample for a defined level of risk acceptance. Such a portfolio analysis mechanism often uses the principles of the so-called Monte-Carlo simulation.

2. Theoretical background

The concept of Monte-Carlo simulation suggests an association with the casino in Monte-Carlo and not by any coincidence. Even in the case of these simulations, a "dice" is thrown, which is a random element of the simulation. In this case, this throw is to generate a description of the market and other external variables which cannot be determined with sufficient precision in advance and at the same time have a significant impact on the portfolio under study.

The basic principle of the simulation is simple and consists of 5 basic steps:

1. Initialization of the simulation, where on the basis of the input data the structures describing the simulated

environment are prepared and the necessary modules performing the respective calculations are initialized. Parameters for calibration of simulation formulas are obtained from the input data by calculation.

2. A random market setting is generated, which serves as a basis for the implementation of operations by individual modules.
3. Implementation of simulation with the required goal (e.g. a simulation of a change in the market situation, calculation of the monitored risk criterion).
4. Partial results for individual simulations within a given market setting are stored in a predefined repository.
5. The partial results are aggregated into a common set over which the simulation results are derived. It is usually statistical processing of a large amount of data into interpretable results.

Steps 2 and 3 are performed repeatedly to the required number of times. [1]

A typical result of the whole simulation is the sought quantile of a common set, i.e. a value which represents the limit value between acceptable and unacceptable results at the permissible level of risk acceptability. It is also interesting to know the statistical distribution of the portfolio's response to the market developments, or its sensitivity to changes in the market environment.

Equally interesting use of such a portfolio analysis mechanism is to find answers to questions such as:

- What impact can have a growth or a fall in the market prices?
- What if the correlations between risk factors change?
- What impact can market price fluctuations have on the portfolio due to internally set limits?

The answers to these questions are also the domain of a properly designed, implemented and prepared Monte-Carlo simulation. [3]

2.1 The dice roll

As mentioned above, a roll of the dice represents the simulation of a random event or development. For the needs of risk management in companies dealing with trading in energy commodities, these are most often:

- The simulation of the development of market prices and possibly other risk factors (commodity prices, exchange rates, interest rates, portfolio consumption, etc.).
- The simulation of the occurrence of a random event, which may affect the portfolio (power failure, insolvency of a business partner, etc.).
- The simulation of market prices is realized by a suitable stochastic model, which meets the requirements for the dynamics of price development. Such requirements include mainly two key points:

- The generation of market prices within the simulation must be correlated. The correlation is either derived from the past or directly defined for the needs of a specific analysis.
- The simulated prices are kept within a meaningful price range during the simulation. This requirement results from the expected reality of the simulated prices and at the same time allows working with the assumptions of the market development in the case of simulation of different scenarios.

Two models can be shown as examples:

- Random walk model
- Vašíček's model

2.2 Random walk model

Based on historical data, this model describes the daily price change, with no other criteria being placed on the price values and it is allowed to grow or decline up to unacceptable intervals. [2]

Tomorrow's price is modeled as a function of today's price and a random change realized through a change in yield. For practical reasons, a model of price change is considered using the exponential function, i.e.

$$P_i[t + \Delta t] = P_i[t] e^{r_i \Delta t}$$

where $P_i[t]$ represents the price of the i-th market factor (the price of the i-th component of the portfolio) at time t and Δt represents the calculation step, which is usually one trading day and for our needs will be equal to 1. The variable r_i represents the price change modeled as

$$e^{r_i[t]} = \frac{P_i[t + 1]}{P_i[t]}$$

from which

$$r_i[t] = \ln \left(\frac{X_i[t + 1]}{X_i[t]} \right)$$

We get a random process r_i with a normal distribution. Yield development is then modeled by a random walk process:

$$dr_i(t) = \sigma_i dW_i(t),$$

Where σ_i represents the volatility of the i-th market factor and $dW_i(t)$ represents the correlated random price fluctuations and subsequently the simulated price for the next day is derived back as:

$$X_i[t + 1] = X_i[t] e^{r_i[t]}. [4]$$

2.3 Vašíček's model

Vašíček's model is described by the equation

$$dr_i(t) = \lambda_i(\mu_i - r_i(t))dt + \sigma_i dW_i(t),$$

where λ_i represents a measure of the rate of return to the expected value and μ_i represents the expected value, compared to the random walk model, it is supplemented by the so-called mean-reverting term $\lambda_i(\mu_i - r_i(t))dt$, whose task is to model the return of the price to the normal μ_i in case the price is too close to the expected value $\mu_i - r_i(t)$ in the simulation.

The simulation formula consists of two parts. The first part models the expected value in the future and the return of prices to the expected values, and the second part, similarly to a random walk, models the constant changes in the market price.

The main difference in the simulated data versus random walk lies in the development of the long-term volatility, where this model ensures its stabilization at the value

$$\frac{\sigma_i^2}{2\lambda_i}(1 - e^{-1\lambda_i t}).$$

2.4 Calibration of Vašíček's model parameters

The equation of the model

$$dr_i(t) = \lambda_i(\mu_i - r_i(t))dt + \sigma_i dW_i(t)$$

can be rewritten into a differential equation

$$r_i[t+1] = r_i[t]e^{-\lambda_i \Delta t} + \mu_i(1 - e^{-\lambda_i \Delta t}) + \sigma_i \sqrt{\frac{1 - e^{-2\lambda_i \Delta t}}{2\lambda_i}} N_{0,1}$$

, where $N_{0,1}$ represents a random variable of the normal distribution with a mean and a standard deviation of 1. This equation is implemented as a calculation of a simulation model. [6]

The parameters of the equation are set according to the following expressions

$$\begin{aligned} \lambda_i &= -\frac{\ln(a_i)}{\Delta t} \\ \mu_i &= \frac{b_i}{1 - a_i} \\ \sigma_i &= sd(\epsilon_i) \sqrt{\frac{-2\ln(a_i)}{\Delta t(1 - a_i^2)}} \end{aligned}$$

Where the parameters a_i , b_i and $sd(\epsilon_i)$ are expressed by the following expressions

$$\begin{aligned} a_i &= \frac{nS_{ixy} - S_{ix}S_{iy}}{nS_{ixx} - S_{ix}^2} \\ b_i &= \frac{S_{iy} - a_i S_{ix}}{M} \end{aligned}$$

$$sd(\epsilon_i) = \sqrt{\frac{nS_{iyy} - S_{iy}^2 - a_i(nS_{ixy} - S_{ix}S_{iy})}{n(n-2)}}$$

where these are applied

$$\begin{aligned} S_{ix} &= \sum_{t=2}^n r_i[t-1] \\ S_{iy} &= \sum_{t=2}^n r_i[t] \\ S_{ixx} &= \sum_{t=2}^n r_i[t-1]^2 \\ S_{ixy} &= \sum_{t=2}^n r_i[t-1]r_j[t] \\ S_{iyy} &= \sum_{t=2}^n r_i[t]^2. \end{aligned}$$

2.5 Correlation of market factors

In both formulae, there is the part $\sigma_i dW_i(t)$ modeling randomness, which, however, must also meet certain criteria. It is common in markets that if prices change in some direction, this change happens across the whole set of market data. These are usually local changes over time, so there is some buzz in commodity prices. These changes are therefore correlated and must be generated in the simulation.

Technically, it is the generation of n-tuples of uncorrelated random numbers of normal distribution in a precisely defined rotation of the market factor space. This rotation corresponds to the intrinsic elements of the correlation matrix and by back-transformation into the basis of the simulation we get an n-tuple of correlated changes modeling a possible change in the market. [2]

3. Implementation testing methodology and results

To test the suitability of the Monte-Carlo simulation for energy trading processes, a model use case was conducted. The goal of the model use case was to test the performance and efficiency of a specific modular Monte-Carlo simulation while conducting complex calculations. To conduct the test case, a server with the following configuration was used:

Table 1 Server Configuration

Processor	Intel Xeon X5650 2,7 GHz
Ram	14 GB
Operating System	Windows Server 2019 Standard

Efficient simulation of such complex processes like energy market requires immense number of simulation iterations working with hundreds of parameters. To get realistic information, we chose a model trading portfolio consisting of 24 positions dedicated to trading electricity or gas on six different European commodity markets (SK, CZ, HU, AT, DE, PL). Then we used a specially modified 3 module Monte-Carlo simulation in order to simulate 10 000

iterations of how will the Value at risk change over the next 100 days.

Table 2 Simulation description

<i>Simulation attribute</i>	<i>Value</i>
Modules	3
Market Positions	24
Products	300
Market attributes	100
Number of Iterations	10000

This model situation represents only a very modest trading portfolio but still produces an immense need for complex calculations. Time is a crucial parameter for playing the market, so we wanted to know how quickly the simulation can run and if the time can be decreased by using multiple threads.

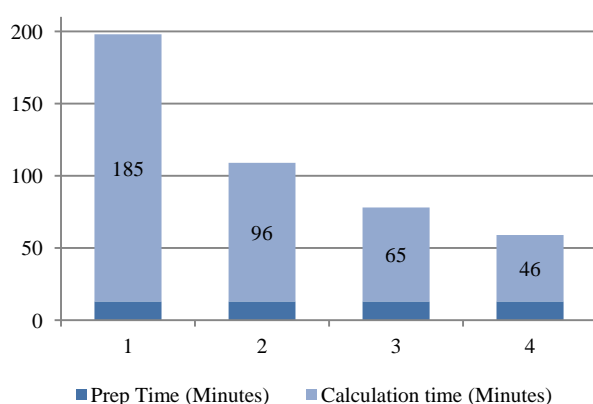


Figure 1: Simulation length depending on number of threads used

Since the modular Monte-Carlo simulation works with independent iterations, we were able to see significant time reduction by using more calculation threads. The results showed that when using 4 threads on the testing device we were able to obtain results in less than an hour, which shows promise for the implementation of modular Monte-Carlo simulation into the trading ecosystem.

4. Discussion

Based on the expectations described above, the following basic requirements are placed on the implementation of the Monte-Carlo simulation:

- The independence of simulation from other applications
- Scalability and distribution in relation to the available hardware environment
- Modularity and openness of the architecture

In addition to these technical requirements, the requirement for targeted modeled market development with changed simulation parameters is directly enforced. Such a possibility provides a tool for performing the so-called What-If analysis when developments are monitored,

provided that some parameters are fixed or otherwise targeted to define desired market conditions.

As a part of the simulation setup, it is necessary to set the relevant parameters for several different types of calculations, such as:

- technical parameters of the simulation such as the number of cycles, parameters of volatility and correlation calculation, etc.,
- market simulation model,
- the list and source of data that will form the input to the simulation.

The calculation itself then consists of three phases:

- Identification and preparation of data
- Running simulation
- Processing and saving results.

The result will be a set of market variables for market simulation and module data needed to calculate module statistics. One module can be used several times in one simulation in different settings (e.g. VaR calculation for different markets).

In the simulation phase, the data are simulated and an output is prepared, which is stored in the ETRM in the processing phase within its data structures and processes. Each module processes this data with its own logic and ensures the correct storage of data.

After the end of the first phase of the calculation (data preparation), which can take long, all the variables which are subject to simulation are known and there is room for manual setting of some parameters, in order to the so-called What-if analysis, when the user wonders how the result of the simulation would turn out if we assume a development scenario in the market. Such a scenario can simulate:

- fall or growth of prices in the selected period,
- increased price volatility in the selected period,
- distortion of the correlation between selected market factors,
- possibly other parameters related to the specifics/variables of the market simulation model.

The ideal solution is full integration into the company's ETRM system, where the user has all the data available for inputs and at the same time data structures for simulation outputs. If such a solution is not possible, or its implementation is too demanding, then with a suitably chosen architecture, it is possible to implement access through external tools, which is also required on the part of the user, or the ETRM system, generate inputs in a precisely defined form, which are transformed through the created channel into structures for simulation and vice versa transform the results from the output structures into a user-acceptable format.

5. Conclusions

The situation in markets where energy commodities are traded is changing rapidly and dynamically, and these changes can have both positive and negative impacts on the trading portfolio of companies that trade in energy commodities. It is therefore essential to have the tools to not only identify market changes with high volatility but also to simulate such market situations and assess their impact on the trading portfolio.

The Monte-Carlo simulation is a useful tool in the hands of a risk manager who provides such possibilities. Implementing this tool in business processes can help to identify weaknesses in the business strategy in a timely manner and thus create space for timely and correct interventions in the business strategy.

As shown above, the Monte-Carlo simulation can be used in several ways, and a number of adjustable parameters affect its efficiency, accuracy and speed. Therefore, the appropriate system architecture, efficient SW implementation and correct use of Monte-Carlo simulation are crucial for the use of the benefits provided by this method.

The achieved results (publication, patent, protection of industrial property, other activity) were created within the project "Advanced tools for data collection and processing for predicting electricity consumption of the local distribution system", which is supported by the Ministry of Education, Science, Research and Sports of the Slovak Republic within the provided incentives for research and development from the state budget in accordance with the Act no. 185/2009 Coll. on incentives for research and development.

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RESOURCE OPTIMIZATION OF NETWORK SCHEDULE OF INFORMATION SYSTEM WITH INTERRUPTION OF WORK

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Abstract: Improving the efficiency of information systems design is an urgent task. In this work, the optimization of the network schedule resources for the creation of an organization's information system is carried out. A network schedule was developed for the implementation of a set of works when creating an organization's information system. A linear diagram of the execution of a complex of operations and a diagram of resource consumption are built. The optimal solution to the problem has been determined. Optimization of the network schedule is performed under the condition that operations allow for interruptions in execution. The results of the study make it possible to reduce financial costs and increase the validity of decisions made at the design stage of an organization's information system.

Keywords: information system, network diagram, critical path, line diagram, time reserves, optimal solution, resources

1. Introduction

Improving the efficiency of information systems design is an urgent task [1-2]. To solve this problem, the methods of operations research are used. Mathematical models allow you to study phenomena, processes and objects of the subject area with the lowest financial costs [3-16]. This paper considers the optimization of the network schedule by resources, provided that the operations allow for interruption in execution.

2. Statement of problem

Determine the start and end times of the network schedule, at which at any moment of the planned period there would be enough resources to carry out the work and the completion time of the complex would be minimal.

From the first to the second day, two units have been allocated ($R=2$). From the third to the eighth day, three units are allocated ($R=3$). From the ninth to the eighteenth day, there are four units ($R=4$). From the nineteenth to the twenty-fifth day, there are five units ($R=5$). Six units are allocated from the twenty-sixth day ($R=6$). The works of the complex are characterized by the duration of its performance and the amount of resources for its implementation. One kind of resource is considered: workers performing operations. The number of workers is constant.

3. Algorithm for solving the problem

The algorithm for solving the problem includes stages.

Stage 1. A line diagram of the implementation of a complex of works and a diagram of resource consumption are built.

Stage 2. The start and end of the complex works are projected onto the time axis. The interval $(\tau_k; \tau_{k+1})$ on the time axis is determined.

Stage 3. Determine the total time reserves of the work R_{ij}

located above the interval $(\tau_k; \tau_{k+1})$.

Stage 4. The selected works are numbered in ascending order of the total time reserves.

Stage 5. The quantities of work resources are summed up in ascending order of numbers. If the amount of resources is less than the available resources, then the work does not move. Otherwise, the work is shifted by the amount of the gap $(\tau_k; \tau_{k+1})$.

Stage 6. If the operation to be shifted starts from the left τ_k then the operation is divided into parts. The first part of the operation is a segment from the beginning to τ_k . The first part of the operation remains in place. The second part is a segment from beginning τ_k to end. The second part is shifted to the right by the size of the interval $(\tau_k; \tau_{k+1})$. The parts of the divided work are treated as independent operations.

Stage 7. The process is iterative until τ_{k+1} reaches τ_{cr} .

To create a line chart, define a list of work stages, time, and number of employees. The content, time of work and number of workers are resulted in table 1.

Table 1. List, time of network activity and number of workers

Activity code	Statement of activity	Duration t_{ij}	Number of workers r_{ij}
1-2	Development of technical specification. Development of technical design. Coordination of technical specification with technical design. Adoption of technical specification. Adoption of technical design	2	2
2-3	Inspection and analysis of administrative buildings of management in Kurgan	8	2
2-4	Inspection and analysis of	6	4

	administrative buildings of management in regional departments		
3-5	Realization of groundwork in management in Kurgan	2	2
4-5	Realization of groundwork in regional departments	4	2
5-6	Development of structure of computer network. Choice and justification of network architecture of computer network. Choice of satellite Internet provider. Purchase of computation, network equipment. Purchase of satellite equipment. Purchase of software	5	5
6-7	Delivery of computation, network equipment into management. Delivery of satellite equipment into management in Kurgan. Delivery of software into management	2	1
6-8	Delivery of equipment into regional departments. Delivery of satellite equipment into regional departments. Delivery of software into regional departments	4	2
7-9	Installation of computer network in management. Installation of satellite equipment in management. Connection of network equipment in management in Kurgan. Connection of satellite equipment in management in Kurgan. Software installation in management in Kurgan	5	4
8-9	Installation of computer network in regional departments. Installation of satellite equipment in regional departments. Connection of computer network in regional departments. Connection of satellite equipment in regional departments. Software installation in regional departments. Hardware setup in regional departments	4	2
9-10	Personnel training. Computer system testing. Personnel examining. Acceptance of information system into service	2	1

The activity network is shown in figure 1. Arrows of the activity network have time of network activity t_{ij} and number of workers r_{ij} .

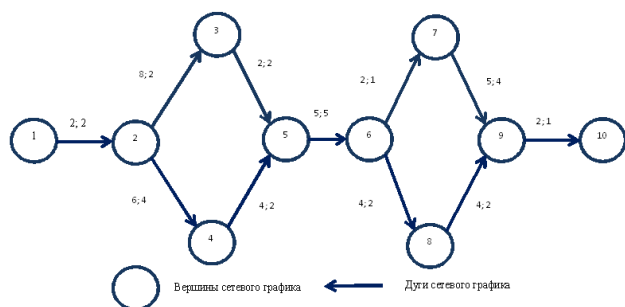


Figure 1. The activity network

Time parameters of events of the activity network count for definition of a critical path. Earliest expected event time is calculated according to the formula

$$ES_j = \max_{i,j} \{ES_i + t_{ij}\}$$

where, ES_j = earliest expected time of event j and ES_i = earliest expected time of event i and t_{ij} = time of network activity i, j .

Latest event occurrence time is calculated according to the formula

$$LC_i = \min_{i,j} \{LC_j - t_{ij}\}$$

where, LC_i = latest occurrence time of event i and LC_j = latest occurrence time of event j .

The algorithm of critical path includes stages.

1 Stage. Earliest expected time of event i is equal to latest occurrence time of event i .

$$ES_i = LC_i$$

2 Stage. Earliest expected time of event j is equal to latest occurrence time of event j .

$$ES_j = LC_j$$

3 Stage. Difference between earliest expected time of event j and earliest expected time of event i is equal to difference between latest occurrence time of event j and latest occurrence time of event i . Difference between latest occurrence time of event j and latest occurrence time of event i is equal to time of network activity i, j .

$$ES_j - ES_i = LC_j - LC_i = t_{ij}$$

Diagrams of the required and available number of workers are shown in figure 2.

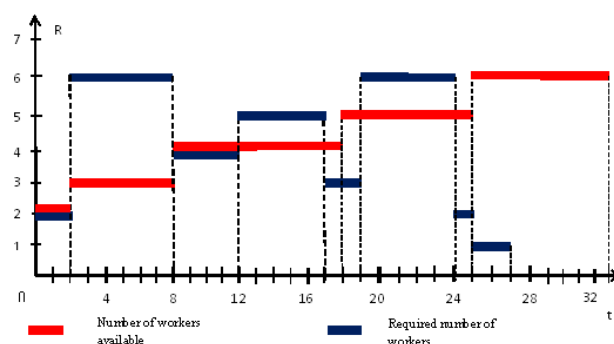


Figure 2. Diagrams of the required and available number of workers

4 The solution of the problem

The linear diagram of the execution of a complex of works with intervals $(\tau_0; \tau_1)$ and $(\tau_1; \tau_2)$ is shown in figure 3.

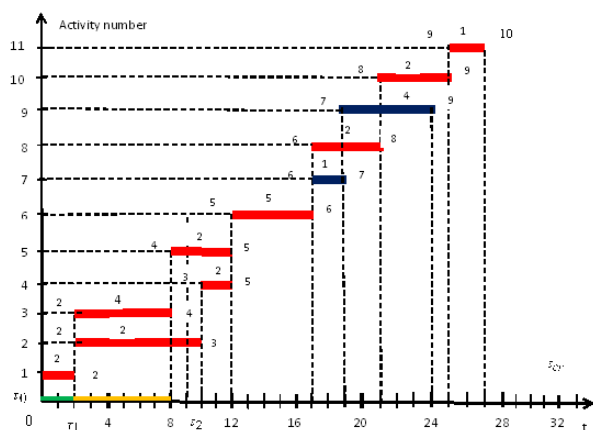


Figure 3. The linear diagram of the execution of a complex of works with intervals $(\tau_0; \tau_1)$ and $(\tau_1; \tau_2)$

The network diagram with the critical paths is shown in figure 4.

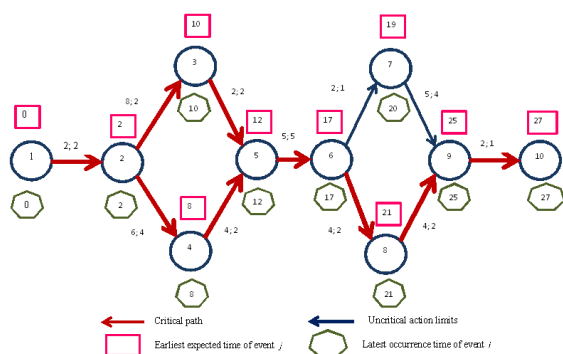


Figure 4. The network diagram with the critical paths

The critical path time is 27 days. Critical path topology: 1->2->4->5->6->8->9-10 and 1->2->3->5->6->8->9->10. A line diagram of a complex of works with an interval $(\tau_2; \tau_3)$ is shown in figure 5.

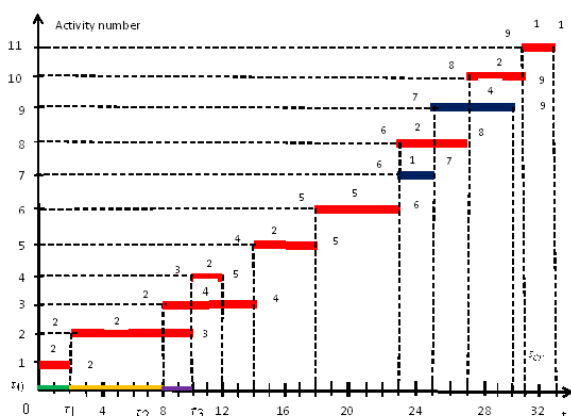


Figure 5. A line diagram of a complex of works with an interval $(\tau_2; \tau_3)$

A line diagram of a complex of works with an interval $(\tau_3; \tau_4)$ is shown in figure 6.

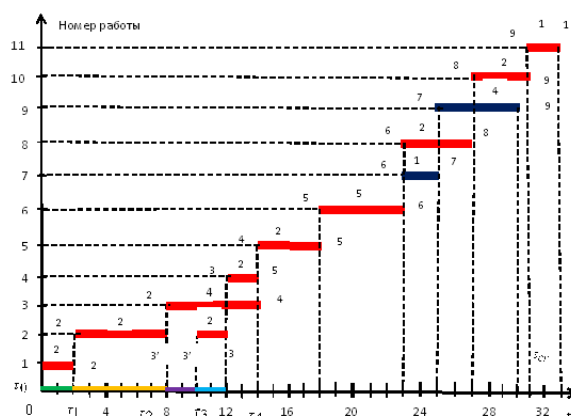


Figure 6. A line diagram of a complex of works with an interval $(\tau_3; \tau_4)$

A line diagram of a complex of works with an interval $(\tau_4; \tau_5)$ is shown in figure 7.

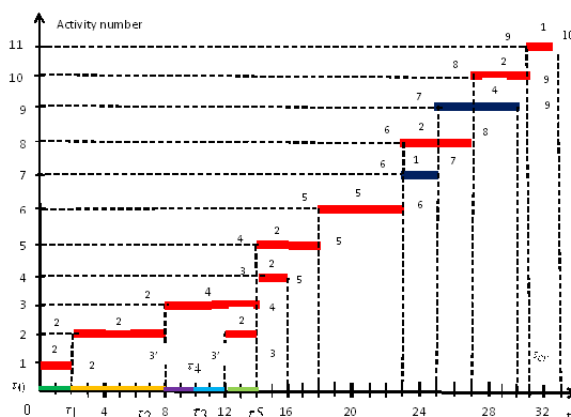


Figure 7. A line diagram of a complex of works with an interval $(\tau_4; \tau_5)$

A line diagram of a complex of works with an interval $(\tau_5; \tau_6)$, $(\tau_6; \tau_7)$, $(\tau_7; \tau_8)$, $(\tau_8; \tau_9)$, $(\tau_9; \tau_{10})$, $(\tau_{10}; \tau_{11})$, $(\tau_{11}; \tau_{12})$, $(\tau_{12}; \tau_{13})$ is shown in figure 8.

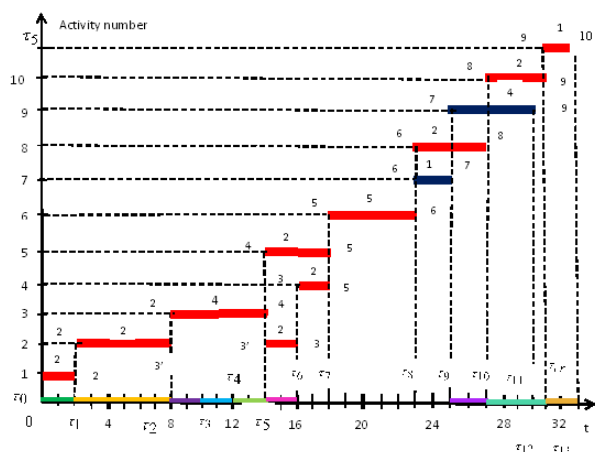


Figure 8. A line diagram of a complex of works with an interval $(\tau_5; \tau_6)$, $(\tau_6; \tau_7)$, $(\tau_7; \tau_8)$, $(\tau_8; \tau_9)$, $(\tau_9; \tau_{10})$, $(\tau_{10}; \tau_{11})$, $(\tau_{11}; \tau_{12})$, $(\tau_{12}; \tau_{13})$

The optimal network diagram with critical paths is shown in Figure 9.

The critical path time is 33 days. Critical path topology: 1->2->4->5->6->8->9->10 and 1->2->3'->3->5->6->8->9->10.

The required and available number of workers after optimization by resources are shown in figure 10.

In order to perform a set of works with minimal time, provided that at any moment of the planned period there will be enough resources to perform the works, you should perform the actions: work (1,2) not shift at interval $(\tau_0; \tau_1)$; work (2,4) shift by 6 days at interval $(\tau_1; \tau_2)$; work (2,3) not shift at interval $(\tau_1; \tau_2)$; work (2,3) split into two parts (2,3') and (3', 3) at interval $(\tau_2; \tau_3)$, work (3',3) shift by two days; work (3',3) shift by 2 days in the interval $(\tau_3; \tau_4)$; work (3',3) shift by 2 days in the interval $(\tau_4; \tau_5)$.

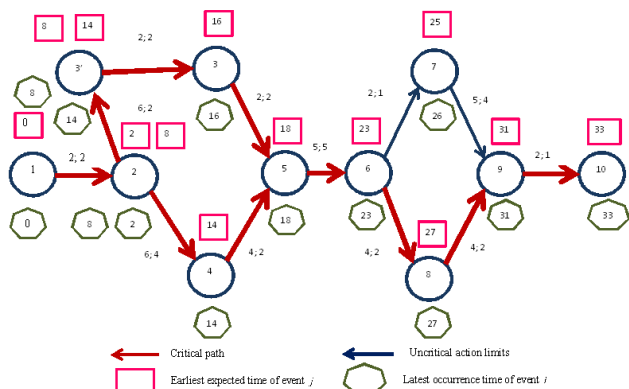


Figure 9. The optimal network diagram with the critical paths

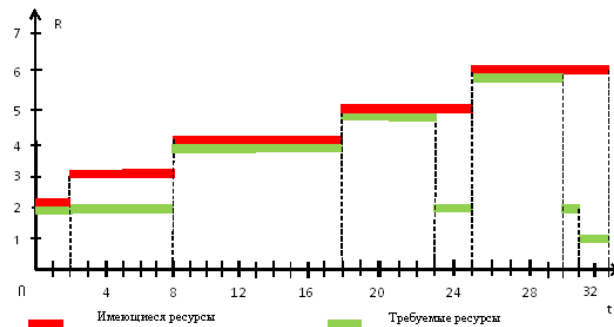


Figure 10. Diagrams of the required and available number of workers after resource optimization

5 Results of research

The results of the research allow us to draw the following conclusions.

1. A line diagram and a network schedule for the implementation of a set of works when creating an organization's information system have been developed.
2. Optimization of the network schedule resources was performed using a linear diagram of the complex of works.
3. The time and topology of the critical path are determined.
4. The application of the results obtained allows you to reduce financial costs and increase the validity of the decision when designing information systems of organizations.
5. The received results can be used in the further researches on the this topic.

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TERPENOIDS AND ALKALOIDS AS POTENTIAL SARS-COV-2 3CL^{Pro} (M^{Pro}) PROTEASE INHIBITORS - A MINI REVIEW

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Abstract: Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is a viral respiratory disease that has caused a global pandemic. An important target for the inhibition of this virus is 3CL^{Pro}, also known as the main protease M^{Pro}. A possible treatment for this disease may be the use of plant materials containing a number of low molecular weight compounds. These secondary metabolites act as a weapon against microorganisms, enzymes or cancer cells. These compounds can be divided into terpenes, nitrogen-containing compounds, sulphur-containing compounds and phenols based on their chemical structure. Terpenes and alkaloids are among the potential inhibitors of the 3CL^{Pro}. According to available *in silico* analyses, these compounds have a significant binding energy value, but their activity must be verified by *in vitro* and *in vivo* tests.

Keywords: SARS-CoV-2, 3CL^{Pro}, inhibitors, terpenoids, alkaloids

1. Introduction

Coronaviruses (positive-sense single-stranded RNA viruses) are viruses involved in serious human and animal diseases. These viruses belong to the subfamily *Orthocoronavirinae*, in the family *Coronaviridae*, order *Nidovirales*, and realm *Riboviria*. This subfamily consists of four genera- *alphacoronavirus* and *betacoronavirus*, which infect mainly mammals, and *gammacoronavirus* and *deltacoronavirus*, which infect various animals, including birds. COVID-19 disease (Acute Respiratory Distress Syndrome, ADRS) is caused by the *betacoronavirus* SARS-CoV-2, which has ~89% genome sequence identity with SARS-CoV and 50% with MERS-CoV. Proteolytic processing during viral maturation is encoded by two proteases, papain-like protease (PL^{Pro}) and 3-chymotrypsin-like cysteine protease (3CL^{Pro}). Inhibition of these two enzymes represents an interesting treatment option for COVID-19, and various synthetic, as well as natural compounds, can be used for this purpose [1,2].

Therefore, the aim of this work was to provide an overview of inhibitors from the group of terpenoids and alkaloids against the cysteine protease 3CL^{Pro}.

2. 3CL^{Pro} SARS-CoV-2

3CL^{Pro} (M^{Pro}- main protease) is a cysteine protease responsible for the hydrolysis of viral polyproteins (pp1a and pp1ab) and the formation of functional proteins during viral replication [3]. This protease has a 96 % amino acid residue match with SARS-CoV 3CL^{Pro}. 3CL^{Pro} represents a dimer with the catalytic dyad His 41-Cys 145 located in the S1 subsite. Three domains are present in the protein: I (residue 8-101), II (residue 102-184; with N-terminal residues) and III (residue 201-303) (Figure 1) [4].

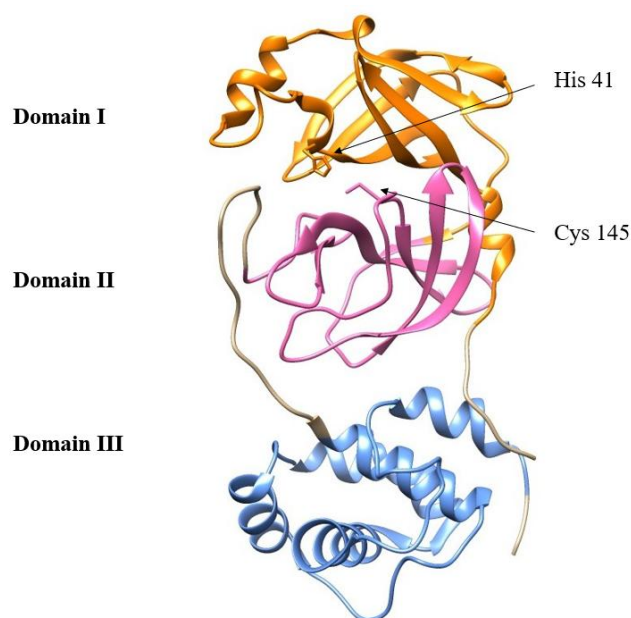


Figure 1: Tertiary structure of the 3CL^{Pro} SARS-CoV-2 (PDB ID: 3LU7)

The active residues are located in the gap between domains I and II, and are distributed on the S1-S6 subsite. Compared to SARS-CoV 3CL^{Pro}, the amino acids of the active site are oriented in the same direction, except for Ala 46 in the S2 subsite, which is replaced by a serine residue in the original 3CL^{Pro}. Substitution of Thr 285 for alanine and Ile 286 for leucine in the original protease SARS-CoV 3CL^{Pro} results in a closer packaging of domain III in the protease dimer, which increases catalytic activity [4]. This protein is an interesting target of inhibition because it is essential for virus replication, but is not found in host cells. Inhibition of this enzyme has been the subject of many studies, with inhibition by various peptides or proteins [5]. However, low molecular weight non-proteinaceous compounds, such as plant secondary

metabolites, can also be inhibitors [2,6]. This direction opens new avenues for further development of new antiviral compounds [7].

2.1 Low molecular 3CL^{Pro} protease inhibitors

Plant material is a rich source of non-protein compounds, especially secondary metabolites, which exhibit antiprotease [2,6,8], antioxidant [9,10] antibacterial [11], or antifungal activity [12]. Potentially inhibitory secondary metabolites of plants are alkaloids and terpenoids. Some studies suggest that these compounds also have potential as antiviral drugs against 3CL^{Pro}.

Terpenes

The basic monomer of these compounds is isoprene (C₅H₈), also referred to as the isoprene unit. The acetyl-CoA molecule (acetyl-coenzyme A) or its intermediates represent their biosynthetic origin [13]. According to the number of isoprene units, terpenes can be divided into hemiterpenes, monoterpenes, sesquiterpenes, diterpenes, sesterterpenes, triterpenes, sesquaterpenes, tetraterpenes and polyterpenes [14]. This group of secondary metabolites exhibits a wide range of biological activities, including antioxidant [15], anti-inflammatory [16,17] or anticancer activity [14]. Experimental works about 3CL^{Pro} (SARS-CoV-2) inhibition by this group of compounds are currently only *in silico* studies [18,19] (Table 1).

Table 1 The comparison of the binding energies for terpenes against the 3CL^{Pro} SARS-CoV-2.

Ligands	Binding energy [kcal/mol]	References
STANDARD INHIBITORS		
N3	-8.15	[23]
Ritonavir	-7.00	[18]
Lopinavir	-8.40	
TERPENES		
6-Oxoisoiguesterin	-9.10	[18]
22-Hydroxyhopan-3-one	-8.60	
Oleanolic acid	-8.50	
3-Oxolupenal (3-oxolup-20(29)-en-30-al)	-8.40	
2,3,19-Trihydroxy-urs-12-20-en-28-oic acid	-8.40	
Methyl tanshinonate	-9.85	[20]
Sugiol	-7.63	
α -Cadinol	-6.67	
Cryptotanshinone	-5.91	
Dehydroabieta-7-one	-5.44	
3- β -Friedelanol	-4.85	[24]
Scalarane	-8.20	
Lactucopicrin 15-oxalate	-8.20	
Lactucopicrin	-7.80	
(5S,9S,10S,13E)-labda-7,13-dien-15-yl diphosphate	-7.80	
11,13-dihydrolactucin 15-oxalate	-7.60	[21]
Taraxasterane	-7.60	
Friedelane	-7.50	
9-cis- β , β -carotene	-7.20	
β -sitosterol	-8.00	

Gyebi et al. (2020) [18] investigated the effect of 100 terpenes and their derivatives on SARS-CoV-2, SARS-CoV and MERS-CoV virus 3CL^{Pro} protease using *in silico* analyses. These terpenes can inhibit 3CL^{Pro} of various viruses with a highly conserved inhibitor pattern, and 6-oxoisoiguesterin and 22-hydroxyhopan-3-one were identified as the most effective inhibitors of this group. The efficacy of these agents was compared with the reference inhibitors ritonavir and lopinavir. For these compounds, the binding energy ΔG (kcal/mol) was higher to standard inhibitors (ritonavir -7.0; lopinavir -8.4; 6-oxoisoiguesterin -9.1 and 22-hydroxyhopan-3-one -8.7). The authors found that the first inhibitor had a markedly similar ligand-binding pattern with ritonavir on the catalytic dyad (Cys145 and His 41) and the amino acid region His 163/His 172/Glu 166. These results suggest that there is conservation of this region, and the inhibitors of the 3CL^{Pro} SARS-CoV can inhibit also SARS-CoV-2, but this pattern has been not observed in MERS-CoV. Diniz et al. (2020) identified compounds such as methyl tanshinonate, sugiol and α -cadinol ($\Delta G < -5$ kcal/mol) as important for 3CL^{Pro} protease inhibition by molecular docking. The first two terpenes bind to the same region of the cavity containing S2, S3 and S4 (they bind to the same region of the pocket that containing its S2, S3, and S4 subcavities). The α -cadinol is bound only to the S2 region, and the other compounds were not bound to the amino acid Cys 145 forming catalytic dyad. β -sitosterol is also a potentially important compound with an inhibitory effect on 3CL^{Pro} [21,22].

Alkaloids

Alkaloids are an important group of plant secondary metabolites. They are nitrogen-containing substances and have several therapeutic effects. As they also have inhibitory effects against some viral diseases, their use in the treatment of Covid-19 may play an important area in research. Most studies of 3CL^{Pro} inhibition by alkaloids were focused on *in silico* assays. Gyebi et al. (2020) [18] also studied the *in silico* effect of 62 alkaloids present in various species of African plants on 3CL^{Pro} activity. The alkaloids 10-hydroxyusambarensine and cryptoquindoline were identified as suitable candidates for further experimental assays. Binding energy (kcal/mol) was higher compared to standard inhibitors (ritonavir -7.0; lopinavir -8.4; 10-hydroxyusambarensine -10.1 and cryptoquindoline -9.7).

Chowduhry (2020) [21] performed *in silico* analysis of the phytochemicals, present in the Indian plant *Tinospora cordifolia*, on 3CL^{Pro} activity. They found that the most suitable candidate from tested alkaloids (berberine, choline and tetrahydropalmatine) was berberine (-7.7 kcal/mol) by docking analyses with AutoDock Vina.

Berberine as a potent 3CL^{Pro} inhibitor was also confirmed *in silico* analysis by Narkhede et al. (2020) [22], but the authors also tested the effect of other alkaloids (Table 2) by AutoDock Vina. The authors in this study docked selected alkaloids into the active site, and the crystal

structure of 3CL^{Pro} with N3 inhibitor was used (PDB ID: 6LU7). Active site analysis identified the major amino acid residues that are associated with ligand binding- Pro 168, Ala 191, Thr 190, Glu 166, Gln 189, Met 49, Arg 188, His 41, Asp 187, His 164, Cys 145, Gly 143, Thr 26, Thr 24, Thr 25, Ser 144, Met 165, Asn 142, His 163, His 172, Gln 192, Leu 141 and Phe 140. The compounds with the lowest binding energy value, such as rhein, are important and could be used in the treatment of SARS-CoV-2 [22].

Table 2 The comparison of the binding energies for alkaloids against the 3CL^{Pro} SARS-CoV-2.

Ligands	Binding energy [kcal/mol]	References
STANDARD INHIBITORS		
N3	-8.15	[23]
Ritonavir	-7.00	[18]
Lopinavir	-8.40	
ALKALOIDS		
10-Hydroxyusambarensine	-10.00	[18]
Cryptoquindoline	-9.70	
Cryptospirolepine	-9.20	
Chrysopentamine	-8.50	
Isocryptolepine	-8.50	
Berberine	-7.70	[21]
Octacosanol	-7.10	
Tetrahydropalmatine	-6.40	
Choline	-3.30	
Rhein	-8.90	[22]
Tryptanthrine	-8.20	
Berberine	-8.10	
Glycyrrhizin	-8.10	
Indirubin	-7.60	
Indican	-7.50	
Bicylogermecrene	-6.50	
Emetine	-10.17	[23]
Tomatidine	-9.58	
Sophaline D	-8.79	
Thalimonine	-8.39	
Cryptomisine	-10.60	[25]
Cryptospirolepine	-10.00	
Cryptoquindoline	-9.50	
Biscryptolepine	-8.80	
Cryptolepicarboline	-8.20	
18-Hydroxy-3-epi-alpha-yohimbine	-8.10	[26]
Alloyohimbine	-8.00	
Vincapsine	-7.50	
(-)-asperlicin C	-9.70	[24]
Cassameridin	-9.30	
Oriciacridone F	-9.10	
(+)-asperlicin E	-8.80	
(+)-Atherospermoline	-8.30	

Garg and Roy (2020) [23] also evaluated the inhibitory effect of 20 alkaloids on the activity of this protease (PDB ID: 6LU7). Of the 20 alkaloid structures, 17 were useful as potential drug candidates. Of these, 4 alkaloids had a lower binding energy than standard N3 inhibitors, and emetine (-10.17 kcal/mol) was identified as the most effective inhibitor. By MD simulation (molecular dynamics simulation), the authors predicted biological activity and determined that thalimonine and sophaline D have a high

potential to be potent inhibitors of 3CL^{Pro}. However, the results must be further confirmed by *in vitro* analyses.

The potential inhibitory effect of 13 alkaloids in the plant species *Cryptolepis sanguinolenta* and their effect on 3CL^{Pro} activity was reported by Borquaye et al. (2020) [25]. Using the standard 6LU7 sequence from the PDB database (Protein Data Bank www.rcsb.org), the authors identified cryptomisine and cryptospirolepine (Table 2) with the lowest binding energy as potentially important alkaloids. All alkaloids are able to cross the blood-brain barrier and also have a high absorption index in the gastrointestinal tract. Gurung et al (2020) [26] tested a group of 263 phytochemicals belonging to different classes of secondary metabolites (prenol lipids, flavonoids, indoles and derivatives, alkaloids, lignans, organooxygen compounds, etc.) and found that 46 substances are orally bioactive, non-tumorigenic, non-mutagenic, non-irritant and without any side effects on reproductive health. The results of the docking analyses show that only three compounds have a potential inhibitory effect (Table 2). This group of secondary metabolites appears to have a significant antiviral effect against SARS-CoV-2. Joshi et al. (2020) [24] investigated more than 7,100 compounds belonging to flavonoids, alkaloids or terpenoids from plants used in Ayurvedic medicine and identified several substances that formed a strong complex with 3CL^{Pro}. They can potentially be used as inhibitors of human angiotensin converting enzyme A (hACE-2) and RNA-dependent polymerase (RdRp). The binding energy of the monitored alkaloids is summarized in Table 2.

3. Conclusions

Plant secondary metabolites have interesting biological properties and can be used in various applications. These compounds have a wide range of inhibitory activities against enzymes, viruses, microorganisms or cancer cells. Terpenoids and alkaloids as representatives of a group of plant secondary metabolites can potentially be used in the treatment of SARS-CoV-2. According to the available results of *in silico* assays, these compounds have an inhibitory effect on 3CL^{Pro}. There are a lot of studies about *in silico* analysis, but the results of *in vitro* and *in vivo* tests are currently not available. Methyl tanshinonate, 6-oxoisoguesterine and 22-hydroxyhopan-3-one (terpenes), and cryptomisine, emetine, cryptospirolepine and 10-hydroxyusambarensine (alkaloids) are very promising inhibitory compounds against 3CL^{Pro}.

Acknowledgements

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POLYPHENOLS AS POTENTIAL SARS-COV-2 3CL^{Pro} (M^{Pro}) PROTEASE INHIBITORS - A MINI REVIEW

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Abstract: The worldwide pandemic of COVID-19 (coronavirus disease 2019) is caused by the SARS-CoV-2 virus (Severe Acute Respiratory Syndrome Coronavirus 2). The 3CL^{Pro} protease, also known as the main protease M^{Pro}, is an important target for SARS-CoV-2 virus inhibition and generates 11 non-structural proteins (NSP). Various synthetic or natural compounds can be used to inhibit it, and these compounds can be of a proteinaceous or non-proteinaceous. Polyphenols represent an important group of secondary metabolites of plants from the group of natural compounds. In this case, inhibitory activity against 3CL^{Pro} was demonstrated not only *in silico* but also *in vitro*. Polyphenols such as quercetin, rutin or myricetin have been identified as targets of interest for future treatment of COVID-19.

Keywords: SARS-CoV-2, 3CL^{Pro}, inhibition, polyphenols, flavonoids

1. Introduction

The SARS-CoV-2 virus invading the human body caused a global pandemic in early 2020 (Mar 11th, 2020) [1,2]. According to available WHO data, 240,405,321 people were infected with the disease, and 4,897,608 people died worldwide. In the Slovak Republic, the total number of infected people was 431,757, and 12,791 people succumbed to this disease (from Nov 2019 to Oct 15th 2021; worldmeters.info). Coronaviruses (positive-sense single-stranded RNA viruses) are systematically included in the family *Coronaviridae*, the subfamily *Orthocoronavirinae* and the order *Nidovirales* [3]. These viruses are responsible for various respiratory diseases, such as Severe Acute Respiratory Syndrome (SARS-CoV), which appeared in 2002-2003, but also Middle East Respiratory Syndrome (MERS-CoV), which appeared in 2012-2013 [4].

Although we already know about effective vaccines to reduce the spread of the virus and the symptoms of the disease in infected individuals [2], there is also interest in drugs that work effectively against the virus. Synthetic and natural compounds can be used for this purpose. Of interest are low molecular weight compounds representing secondary metabolites of plants [5-8].

This work aimed to provide an overview of low molecular weight compounds, specifically phenolic compounds, which can inhibit the SARS-CoV-2 3CL^{Pro}.

2. 3CL^{Pro} SARS-CoV-2

Sequencing of SARS-CoV-2 virus revealed ~89% sequence identity with SARS-CoV virus [9]. The virus has a similar genetic organization to this virus: the 5'-untranslated region followed by non-structural proteins and structural proteins. Non-structural proteins include the ORF complex (ORF-open reading frame; ORF1a and ORF1b), also referred to as the replicase complex. Structural proteins include proteins such as spike protein (S), envelop protein (E), membrane protein (M) and

nucleocapsid (N), situated with other proteins at the 3' end [10] (Figure 1).

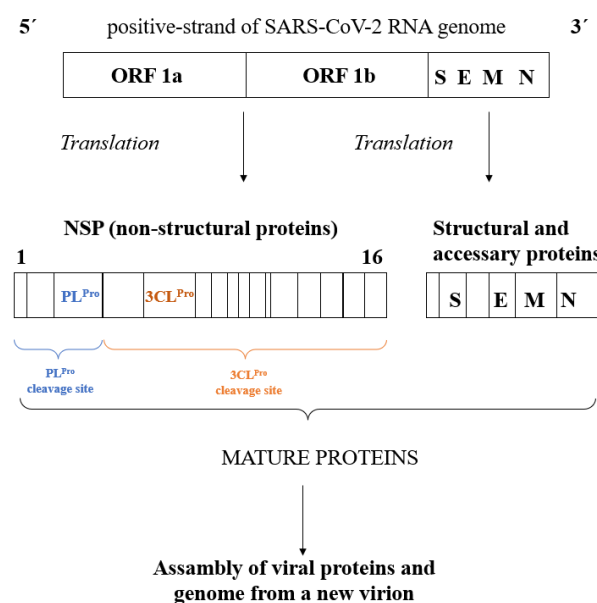


Figure 1 RNA genome of SARS-CoV-2 (according to Mody et al., 2021).

The beginning of the life cycle of the SARS-CoV-2 virus represents the binding of the spike protein to its receptor present in the host cells and the subsequent fusion of the viral envelope with the host cell membrane [11]. Upon release of the viral genome into the host cell environment, a new polyprotein (PP) is formed, which is cleaved by two proteases, papain-like protease (PL^{Pro}) and 3C-like cysteine protease (3CL^{Pro}), also called the main protease (M^{Pro}). 3CL^{Pro} (M^{Pro}) is encoded by the viral genome and non-structural proteins (NSPs) are produced by the cleavage. These proteins are essential for viral replication. After genome replication and translation, the NSPs, structural, and helper proteins are associated with the RNA

genome of the virus to form a new virion. The significance of the 3CL^{Pro} inhibition strategy is mainly in the fact that the PL^{Pro} and 3CL^{Pro} proteases cleave PP into 16 NSPs. 3CL^{Pro} is responsible for the proteolytic cleavage of 11 NSPs [12, 13].

2.1 Polyphenols as potential 3CL^{Pro} protease inhibitors

Phenolic compounds represent a basic group of secondary metabolites of plants characterized by the presence of one or more aromatic rings. These compounds are the products of the pentose phosphate, shikimate or phenylpropanoid pathway [14].

Nguyen et al. (2021) evaluated the inhibitory effect of 49 standards of phenolic compounds and black garlic extract on 3CL^{Pro} activity. The 3CL^{Pro} protein was isolated as a 34.5 kDa protein expressed in *Escherichia coli* BL21, and the IC₅₀ value was determined. The plant extract had the IC₅₀ value of 137 µg/ml, and the most effective inhibitors from the group of phenolic compounds were tannic acid (9 µM), puerarin (42 µM) and daidzein (56 µM). In all cases, the authors noted 100% inhibition of the protease. In addition, the authors determined the effect of phenolic compound structure and inhibitory activity. The presence of a hydroxyl group in C3, C4 and C5 of the B-ring, C3 in the C-ring and C7 in the A-ring increases the inhibitory effect of the phenolic compounds. The double bond between C2 and C3 in the C-ring and glycosylation at C8 in the A-ring simultaneously contribute to the inhibitory effect. The effect of methanolic plant extracts containing polyphenols capable of inhibiting 3CL^{Pro} activity was also studied by Guijarro et al. (2021). The *E. coli* BL2 expression system was used to express the 3CL^{Pro} protein. Extracts from turmeric (*Curcuma longa*) rhizomes, mustard (*Brassica nigra*) seeds, and wall rocket (*Diplotaxis erucoides* subsp. *erucoides*) at a concentration of 500 µg/ml were evaluated as the most inhibitory active extracts. The residual protease activity was 0.0, 9.4 and 14.9%, respectively, and the values of the inhibition constant (Ki) and IC₅₀ are recorded in Table 1. The screening of 150 compounds and their effect on 3CL^{Pro} activity was evaluated by Abian et al. (2020). Quercetin with the lowest Ki value was set to be the most effective inhibitory compound. To confirm the interaction, quercetin was docked into the active site and the binding affinity was evaluated in the range of -7.5 to -7.2 kcal/mol. *Ampelopsis grossedentata* can also be an important plant source of inhibitory active compounds, especially polyphenols [17]. The residual activity of 3CL^{Pro} in the presence of this extract (the final concentration was 100 µg/ml) was 0.26%. The plant extract was further purified to obtain 5 flavonoids - dihydromyricetin, isodihydromyricetin, myricitrin, taxifoline and myricetin. The Ki and IC₅₀ values were determined for all compounds (Table 1). The covalently bound myricetin inhibitor was subsequently docked with the 3CL^{Pro} protein (PDB ID 6XHU) and an interaction near amino acids Cys 300 and Cys 44 was detected.

In terms of further inhibition of enzymes involved in human diseases, epigallocatechin-3-gallate, used mainly in traditional Chinese medicine, is also a significant phenolic compound. Du et al. (2021) identified this compound as the most potent 3CL^{Pro} inhibitor (IC₅₀ = 0.947 µM), comparing the activity with other compounds commonly present in plant material. The most suitable solution for evaluating the inhibitory effect is a combination of experimental and simulation techniques. Rizzuti et al. (2021) noted a significant inhibitory effect of rutin on 3CL^{Pro} activity and confirmed this character by the Gibbs energy of binding assay (ΔG). The Ki value was 11 µM, and by molecular docking, the authors found that rutin binds in the active site of the enzyme and interacts with the catalytic pair His 41 and Cys 144. The ΔG value was -7.0 kcal/mol. The authors describe the use of quercetin, as a glycosylated derivative of rutin, as an analogue to design antivirals.

Table 1 The comparison of IC₅₀ and Ki values of selected compounds belonging to polyphenols and plant extracts against 3CL^{Pro} SARS-CoV-2.

Polyphenol	IC ₅₀ [µM]	Ki [µM]	References
Tannic acid	9.00	-	[15]
Puerarin	42.00±2	-	
Daidzein	56.00	-	
Myricetin	43.00±1	-	
Quercetin	93.00±5	-	
Quercetin	-	7.40	[16]
Dihydromyricetin	4.91	67.35	[17]
Izodihydromyricetin	3.73	62.43	
Myricitrin	14.22	-	
Taxifolin	72.72	-	
Myricetin	1.21	6.33	
Epigallocatechin-3-gallate	0.85	-	[18]
Quercetin	97.46	-	
Luteolin	89.67	-	
Kaempferol	>100	-	
Naringenin	>100	-	
Rutin	-	11.00	[19]
Plant extract	IC ₅₀ [µM]	Ki [µM]	References
Black garlic (<i>Allium sativum</i>)	137.00±10 µg/ml	-	[15]
Turmeric rhizomes (<i>Curcuma longa</i>)	15.74 µg/ml	-	[7]
Mustard seeds (<i>Brassica nigra</i>)	128.10 µg/ml	-	
Wall rocket (<i>Diplotaxis erucoides</i> subsp. <i>erucoides</i>)	257.40 µg/ml	-	
<i>Ampelopsis grossedentata</i>	3.44 µg/ml	-	[17]

*IC₅₀ – the half-maximal inhibitory concentration; Ki – the inhibition constant

Cannabinoids (CBDs) may also be an interesting group of agents useful in inhibiting SARS-CoV-2. *In vitro* and *in silico* analyses were performed by Rajet et al. (2021), who focused on 32 different CBDs against 3CL^{Pro} activity. Two molecules were important - Δ^9 -tetrahydrocannabinol and cannabidiol, which had comparable IC₅₀ values as lopinavir, chloroquine and remdesivir (Table 2). Molecular

docking analysis was performed with Vina and Autodock, and the binding energy results (kcal/mol) were compared. For Δ^9 -tetrahydrocannabinol, the binding energy value was set to -7.16 and -10.42, respectively, and for cannabidiol -6.43 and -10.53, respectively. The authors also found that these agents can be dual-acting compounds. They inhibit viral translation and are able to reduce the amount of pro-inflammatory cytokines in lung cells acting as an agonist of the cannabinoid type 2 (CB2) receptor.

Compounds such as baicalin, herbacetin and pectolinarin, belonging to flavonoids, can also block the proteolytic activity of 3CL^{Pro} [21]. The lowest IC₅₀ value was observed for baicalin (34.71 μ M), and *in silico* analysis was performed for all mentioned compounds. Docking analyses were evaluated by the Schrödinger software suit (Maestro), and the value of the glide score was -8.776, -8.738 and -10.969, respectively.

Table 2 The comparison of IC₅₀ values of selected compounds belonging to polyphenols against 3CL^{Pro} SARS-CoV-2.

Standard inhibitor	IC ₅₀ [μM]	References
Chloroquine	9.78	[20]
Remdesivir	8.17	
Lopinavir	13.16	
Polyphenol		
Cannabidiol	7.91	[20]
Δ9-tetrahydrocannabinol	10.25	
Cannabinol	11.07	
Δ9-tetrahydrocannabinolic acid	13.17	
Cannabinolic acid	37.61	
Baicalin	34.71	[21]
Herbacetin	53.90	
Pectolinarin	51.64	
Phillyrin	10.00	
Baicalin	6.41	[22]
Baicalein	0.94	
Curcumin	0.44	
Hesperidin	13.25	[23]
Quercetin	18.20	
Hydroxychloroquine	1.72	

*IC₅₀ – the half-maximal inhibitory concentration.

Baicein as potent inhibitor has also been confirmed by Su et al. (2020). Baicein, along with baicalein, is the main ingredient in Shuanghuaglian – the traditional Chinese medicine. The authors identified these compounds as the first non-covalent non-peptide 3CL^{Pro} inhibitors. After determining the X-ray structure of the bound inhibitor, they found that it differed significantly from known inhibitors. Baicalein is located in the core of the substrate-binding site and interacts with two catalytic residues, the S1/S2 sublocalities and the oxyanion loop, thereby effectively preventing the substrate from accessing the active site with the catalytic dyad. The ΔG value for baicalin was -6.74 kcal/mol and for baicalein was -7.36 kcal/mol. The comparison of the inhibitory activity of selected phenolic compounds with the N3 inhibitor standard was determined by Kandeil et al. (2021) (Table 2). Curcumin was identified as the most antivirally active

compound (IC₅₀ = 0.44 μ M). Comparing the results of the docking analyses, they found that the binding score is very similar to the co-crystal structure of this protein with the N3 inhibitor (-9.51 kcal/mol). The lowest value was observed for hesperidin (-8.37 kcal/mol), curcumin (-7.28 kcal/mol), hydroxychloroquine (-7.05 kcal/mol) and the highest for quercetin (6.32 kcal/mol). Although it is a very interesting method, today there are still few works that have evaluated the effect of phenolic compounds not only by *in silico* analyses but also *in vitro*. It is necessary to verify the results of *in silico* docking analyses and to determine the type of inhibition and inhibition constants of the compounds.

3. Conclusion

Although there is much work on the inhibition of 3CL^{Pro} by plant extracts or phenolic compounds, few are concerned with determining the effect by *in vitro* assays. In this work, we summarized the current state of the problem and noticed that important inhibitory compounds against this protease are mainly quercetin, rutin or myricetin - representing secondary metabolites of plants. The binding affinity for these compounds has been verified in the literature by docking analyses and represents promising targets in the treatment of COVID-19.

Acknowledgements

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REPRESENTATION OF THE ROMA HOLOCAUST IN THE PUBLICATION FAREWELL SIDONIA BY ERICH HACKL: PRESENTATION OF RESULTS OF A RESEARCH INVESTIGATION

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Abstract: *The paper deals with the presentation of the results of research, which focused on determining the degree of reception and interpretation of Hackl's publication Farewell Sidonia by pupils of the 7th grade of primary school. After an introduction in which we summarize the importance of a multilateral view of the events of the Shoah and the Holocaust, we present selected publications on the Porajmos, i. e. the Roma Holocaust. The research, selected results of which are part of this article, was conducted through a non-standardized questionnaire, which consisted of an excerpt from a given narrative and five questions related to it. The results showed that the tested students can extract basic information from the text, which they can connect and draw certain conclusions from them. Respondents also have a certain amount of factual knowledge, which is indispensable for an adequate reception of such focused artistic narratives.*

Keywords: *Porajmos, Shoah, Holocaust, Farewell Sidonia, Erich Hackl*

1. Introduction

The issue of the Roma Holocaust, the Porajmos [1] is largely taboo in the context of a period of one line of events in World War II. In most cases, researchers deal with the Nazi extermination machinery during World War II, which was directed against Jews, the Shoah, or various aspects leading to the takeover of the National Socialist Party in interwar Germany. In addition to the aforementioned order, the relationship of the so-called neutral states to the Jewish question, the targeted murder of other national or religious groups and forms can also be included in areas that are in some way displaced outside the main interest of experts.

Tamminen [12 p. 73] comments on the study of the Roma Holocaust in connection with the issue of its unjustified delay: "According to them, his victims were almost exclusively Jews. Frequent Hollywood movies have confirmed this notion. From the Roma point of view, only a few films from recent years tell about the Holocaust, which have remained almost unnoticed." On current research on the Roma Holocaust in the context of nationalist intimidation, Košir [8 p. 250] states: "The archaeology of genocide, war crimes, and mass death has become a growing sub-discipline in recent decades, with the most attention given to the locations of National Socialist 'terror and mass death'. Within genocide research, the Porajmos, or genocide of Romani people, is not a well-known topic..."

To some extent, not only in research dealing with various aspects of World War II Tamminen [12 p. 73] notes: "It was not until the 1980s that historians turned their attention to the mass extermination of Roma. Estimates speak of 500,000 to 1.5 million victims. For example, according to a report by *The International Organization for Migration*, 1.5 million people were murdered. No matter where the exact number is between the two estimates, Roma have been murdered at least as intensely

as Jews in relation to their ethnic numbers." According to historians, a certain perception of selected events of World War II is only about trying to exterminate Jews. inaccurately.

Tamminen [12 p. 318] summarizes the topicality of the tone of defined events in connection with the global events as follows: "In today's development, we can inevitably expect a global ecological crisis within twenty years. The number of refugees will then reach completely different levels. If climate change sets in motion 200 million people from all over the planet, who will be willing to defend human rights, democracy and other supposedly European values?" World War II multilaterally, i.e. through several stakeholders.

We believe that a multilateral view of these events of World War II and their presentation to pupils and students at various levels of institutional education can lead to the elimination of an undesirable schematic view of defined phenomena. At the same time, the approach to some extent ensures the development of students' critical thinking, their ability to argue or their ability to verify and refine various information.

2. Porajmos in the context of current research

Recently, several contributions to the issue of the Shoah have been made in comparison with the Roma Holocaust. Margalit [10] presents significant differences between the killings of these nations. Binder and Ibold [2] focus on documenting Porajmos through the story of a specific person, which is currently one of the most widely promoted methods of introducing various groups of people to the concept of Nazi extermination (compare [9]).

Centner [3 p. 276; compare 7] deals with two literary contributions to Porajmos: "With reference to Walter Benjamin's historical theory, the article investigates how the Porajmos can be told and sheds light on the extent to

which literature can refer to other forms of representation than classical historiography. By re-presenting the events of the past from the present as something new, the texts commit themselves to a political project and become part of the cultural memory.” Piątek’s contribution [11] is devoted to the depiction of the Roma genocide in literature in connection with its educational potential.

Giergiel & Taczyńska [5] discuss the scope of the case in relation to its impact on European society.

3. A research survey focusing on the level of reception and interpretation of Hackl’s publication *Farewell Sidonia*

We are convinced that Erich Hackl’s publication *Farewell Sidonia* has considerable didactic potential. The multilateral view of the events of one line of the Second World War is thematized through the Roma Holocaust.

The main character in Hackl’s narrative is the Romani girl Sidonia, who is adopted by an Austrian couple who disagree with the Nazi regime and even take part in resistance activities. Sidonia grows up in a strongly anti-Semitic and pro-Nazi city, where she encounters open and hidden manifestations of hatred and racism. Perhaps most openly, she is opposed by her classmates, who, influenced by conversations with their parents, speak out against everyone whom Adolf Hitler called undesirable. Sidonia grows up in a constant fear of verbal attacks, on the other hand, she is covered by boundless love and does not feel a material lack. At this point, we see one aspect of the application of multilateralism in the narrative, namely the depiction of the close relationship of individuals of different nationalities, which Nazism elevated to the question of “life and death”.

After a few years, Sidonia’s biological mother turns to the responsible authorities, saying that she would like to take to herself the little girl. After the girl is taken to the meeting place, her mother rejects her. Sidonia’s next fate is only hinted at in the artistic narrative, but it follows that she is transported by train to Auschwitz, where she is murdered in a gas chamber.

The main reason why readers should get acquainted with this publication is seen in the fact that it is devoted to a largely overdue topic, even though the Porajmos acquired considerable proportions during the Second World War. Artistic narrative is based on real events but differs in outcome. The girl whose life destiny the writer worked out, Margit, survived the Nazi extermination machinery. This fact underlines the need to present various events connected with the Second World War through the life destiny of a certain person.

We see a possible benefit of the reception of this text in the fact that readers realize that certain manifestations of racism or intolerance towards the Roma have historical roots, which in a way stagnated during World War II, but did not end, but are still relevant today. Their global and

societal impact with a focus on the European continent may also be highlighted.

3.1 Research methodology

The level of reception and interpretation of the narrative was determined in 14 pupils (8 girls and 6 boys) from the 7th year of basic institutional education through a non-standardized questionnaire, which consisted of an excerpt from Hackl’s publication, which was accompanied by five questions. the degree of understanding of the narrative and the depth of its interpretation by the respondents and, in connection with the topic of the excerpt, also their current knowledge of the Second World War. We are aware that pupils who are currently completing compulsory school attendance become acquainted with historical events connected with the twentieth century in more detail only in the 9th grade within History (see [4 p. 61]); however, we are of the opinion that they are acquainted with some historical stages in other subjects or in cross-sectional topics, which correspond to the defined issues with their expected outcomes.

At the end of the research tool, there was a section in which we found out basic demographic data on pupils relevant to the evaluation of the questionnaires, we found out whether the passage they worked with was long or short for the pupils and whether the research participants read books in their free time. We also asked if the respondents would like to read the entire book from which the sample was excerpted. For the evaluation of the questionnaires, the decisive year is the age affiliation of the respondents, not their age.

In the first phase of the evaluation of the questionnaires, those that were not filled in or in which the above answers did not relate to the question asked at all were excluded. The answers from the questionnaires that met the set criteria were then transcribed by the researcher into a table. Semantically identical statements were recorded in one line with the number of occurrences of the replica. Research tools that did not answer any of the questions were recorded in the table as specific categories of statements. In this way, we have achieved a certain clarity and structuring of them. Subsequently, those that were relevant to the main goal of the research were excerpted.

The research probe was carried out in a primary school in the Hradec Králové region. Due to the COVID-19 pandemic, which prevailed in the Czech Republic at the time of the research, the respondents were given a questionnaire without the presence of a researcher. We are aware that the chosen procedure could have caused the respondents to have certain difficulties in filling out the questionnaire, which could stem, for example, from a misunderstanding of the questions asked. Pupils could, of course, turn to the teacher with their questions, however, we perceive the absence of a researcher in the actual implementation of the survey as a significant deficit.

3.1 Results and discussion

The tested students worked with a demonstration, in the middle of which is a situation where Sidonia's biological mother rejects her. The second part of the excerpt, which was part of the questionnaire for pupils from the 7th grade, depicts a situation where one of Sidonia's foster parents sees a girl on a train heading to Auschwitz. We are convinced that the selected example is emotionally very strong and that it has the potential to engage the reader and encourage them to think about the sound of the chosen narrative.

After reading the passage, the students had to answer five questions. The first one 1) *What did you learn about Sidonia?* aims to understand the text and to find information.

The answer "afraid of the Roma, she was lonely" points to the respondent's misunderstanding of the text.

Pupils also wrote:

- "that she is a little girl married to the Roma;
- she is probably Romani;
- that she did not want to go to her mother, she is a Romani woman, she took the train away;
- it was a little girl who was separated from her parents and taken away by train;
- she is 10 years old, she did not want to go back to her family;
- that she has been adopted;
- Sidonia didn't have the best fate, but she couldn't blame her, she had to be helped by a social worker."

Based on the pupils' answers to the above question, it can be stated that the respondents from the given year were able to find the required information in the text, which in most cases they connected with their previous experience and knowledge. If we decide to offer students this publication for reading in Literary Education, it is necessary for the teacher to know the class sufficiently, because this narrative can cause some strife within the team, especially because of the nationality of Sidonia and also because it was adopted. This fact, with an inappropriately chosen approach by the teacher, can lead to an undesirable impact on the behavior and actions of class members towards their classmates, who may have a similar fate as the representative of Hackl's publication.

Second question 2) *What was the fate of the Roma during the Second World War?* was focused on finding out the level of knowledge of 7th grade students about the Second World War.

Respondents wrote:

- "were taken to concentration camps;
- were underestimated;
- were like cheap labor;

- separated them from their families and treated them ugly;
- sad;
- killed them".

As the answers show, these pupils have a basic knowledge of the fate of the Roma during World War II. It can therefore be stated that they are aware of the similar impact of the Nazi extermination policy on persons of Jewish nationality and on the extermination of Roma during the Second World War. The question is to what extent this knowledge can be related to a certain change in the education of pupils in History associated with a certain transformation of the *Framework Educational Program for Basic Education* [4], which may have encouraged teachers to explicitly mention the fate of Roma during this war: within the expected outcomes of the thematic unit. In modern times, pupils should "use examples of anti-Semitism, racism and their unacceptability" [4 p. 61], or whether a certain enlightenment in the circle of tested pupils is caused by the integration of the cross-cutting theme Multicultural Education into the *Framework Educational Program for Basic Education*.

Third, fourth and last question 3) *Why is the book called Farewell to Sidonia?* 4) *Where could the train with Sidonia have gone? Why do you think so?* 5) *What could have been the fate of Sidonia?* were aimed at making inferences from the text read, at drawing conclusions and at reconciling existing historical and social knowledge about the period of the Second World War with the narrative being read. We looked at the extent to which students mastered certain facts and their level of reading literacy.

The pupils answered the third question uniformly as part of a semantic statement "because Sidonia left by train." This fact demonstrates the ability of students to link the text of the sample with its title.

Question 4) *Where could the train with Sidonia go?* related to the question of the fate of the Roma during World War II.

The tested students wrote:

- "to a concentration camp;
- the train was headed for Steyr because it is in the text;
- to Auschwitz".

If we connect the answers to this question with those asked about the fate of the Roma during the Second World War, we will find that the pupils who were able to answer the previous question did so in this case as well. It can be stated that the replicas were relatively uniform, most of them related to the fate of the Roma during the Holocaust. In the statement "the train was headed for Steyr because it is in the text" (mentioned by 2 pupils), although the respondents do not have sufficient factual knowledge, they nevertheless tried to find the appropriate answer in the

narrative. It was again confirmed that the tested respondents linked the tragic fate of the Jews during the Shoah with the Porajmos.

The fifth question focused on reading-based prediction. To question 5) *What could have been the fate of Sidonia?*

Respondents answered:

- “Sidonia was taken by the train to a concentration camp from which she did not return;
- it may have happened that she managed to escape in some way, but it seems to me that this is not so likely, in my opinion, unfortunately, the girl must have died;
- lived in fear and hunger for years to come;
- to an orphanage”.

As follows from the above, the tested pupils again connected their current knowledge about the fate of the Roma during the Second World War and in a way followed up on some of their answers to the previous questions. We believe that this fact may be due to a certain emphasis on current issues in the field of discrimination, in which certain parallels can be found with the fate of the Roma during the period. We are aware that the given historical period in the connotation with the life of the Roma ethnic group in contemporary society cannot be compared a priori for various reasons, however, it is possible that pupils encounter these issues in various cross-cutting themes, for example, and the genesis and development of racism or various forms of intolerance may be presented in the interpretation.

4. Conclusions

After the theoretical introduction, in which we outlined the importance of presenting a multilateral view of selected lines of the Second World War, we approached the current state of solutions and knowledge in the field of research in the field, from an interdisciplinary point of view. Until recently, the Roma Holocaust was largely delayed, even taboo, at the expense of other lines of the Second War. After the theoretical part of the paper, we presented the research methodology, in the center of which was to determine the degree of reception and interpretation of artistic narratives, in which a multilateral view of one line of events of the Second World War is applied.

The limits of entering the questionnaire in distance learning were reflected in the fact that some students forgot to fill in the last part of the questionnaire, in which we asked their opinion on the length of the sample, whether they read books in their free time and whether reading them to read the entire book from which the passage was selected. Only 10 respondents from the 7th year filled in this section of the research tool. A total of 90 % of the participants in the research survey, who worked with the publication *Farewell Sidonia*, chose the possibility that the passage did not inspire them to read the entire publication. At this point, therefore, the educational

potential of literary works in which the Roma Holocaust is themed was not fulfilled.

Based on the students' answers, it can be stated that the respondents are aware of the parallels between the Shoah and the Porajmos and that they are aware of the impact of these events on both ethnic groups. To a large extent, they can connect current events with events that took place during the 1940s. It can also be said that respondents adequately control the critical thinking (excerpting information, connecting it, drawing conclusions, etc.), the mastery of which is essential for life in today's society.

In most cases, students were able to adequately perceive Hackl's publication. On the other hand, it must be emphasized that this thesis is based on the above results, which were influenced by the fact that respondents have a sufficient amount of factual information, despite the fact that in the *Framework Educational Program for Basic Education* the topic of World War II is rooted in the curriculum for the 9th year. The situation can be explained by the fact that students of compulsory education in the Czech Republic are acquainted with various forms of intolerance, racism or stigmatization and persecution practices in the teaching of various cross-cutting topics, throughout their studies.

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DIGITAL PRELITERACY IN PRESCHOOL EDUCATION: LEARNING BASED ON DIGITAL PLAY

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Abstract: *Preconditions are to be created within preschool education for the later development of digital literacy, which we refer to as digital preliteracy. Preschool education aims to create a space for the children to learn about the initial digital competence. Preschoolers should gradually become acquainted with digital technologies, find out what they are used for and what their purpose is. The paper focuses on the development of digital preliteracy in preschool age through smart toys. It also follows up on the latest annual report from the Czech School Inspectorate on preschool education from which we learn about the low use of interactive toys. The child's interaction with a robotic toy connected to a mobile application goes beyond traditional child's play. It is a kind of spatial game involving endless possibilities of virtual elements. For example, children playing with the IoToys (Internet of Toys) can learn about a new kind of virtuality, engage in sharing their stories and develop their skills with digital technology which is becoming more and more a part of many children's everyday life.*

Keywords: *preschool education, digital preliteracy, digital play, IoToys*

1. Introduction

The first years of life are considered the most important for the formation of children's basic abilities. The period of preschool age is often referred to as the period of flourishing and games. With the help of games, the children prepare for later real life, as they are intentionally placed into model situations that they have to solve and that they may encounter in the future. Thus, games develop children's perception, thinking, learning, but also how to understand the feelings that are the basis for interpersonal relationships. Playing is generally defined as a form of activity that has its specific status in preschool age and has many aspects, such as cognitive, practice, emotional, movement, motivational, creative, imagination, social, therapeutic, recreational, but also diagnostic [1].

Preschool age, marked as a period full of playing, fundamentally influences the toy market and inspires various companies to constantly innovate the ways of using children's toys. Toy industries offer many toys that are intended to stimulate the child's movement, sensory, intellectual or emotional development and promise the development of the child's inner motivation for self-education and creative thinking. The current market brings a number of interactive and robotic toys that would be suitable for preschool education (hereinafter PSED) and should fulfil the vision of quality educational methods in PSED. Likewise, the aesthetics and design of interactive robotic toys should evoke a new kind of experience and moments of surprise for children. Today, toys are increasingly linked to digital technology. One example of such toys are toys associated with the phenomenon of the Internet, the so-called Internet of Toys (IoToys).

2. Preschool Education in the Czech Republic

The aim of PSED is to complement and support family education and to help provide the children with an environment with sufficient multi-faceted and appropriate stimuli for their active development and learning. Current

educational policy in the Czech Republic is based on the belief that a person must be educated throughout life and that they should be interested in their learning and knowledge, allowing them to interact with the world in a better and rich way. PSED is intended to facilitate the child's further life and educational journey. The intention of preschool education is to develop each child physically, mentally and socially and to lead them so that at the end of their preschool period they are a unique and relatively independent personality, able to cope with the demands of life that are normally placed on them (especially in the environment close to them, i.e. in a family and school environment), as well as those that inevitably await them in the future [2].

The current findings of the Czech School Inspectorate (CSI) deal with the long-term unfavourable fact that most teachers still prefer methods that allow only minimal activation of children. Pedagogical situations are thus amplified by the frontal form and by assigning tasks to all children in the same way. Another important finding is the lower willingness of teachers to change and the persisting stereotypes in approaches to education. There is a frequent transfer of finished knowledge to children during education. Activities supporting experimentation, discovering, problem solving, developing children's thinking, their creativity, self-expression and autonomous behaviour are included in a moderate way in the long term. Approaches based on experimentation, discovering, cooperation and problem solving are under-represented. According to the CSI's annual report on PSED, we also learn about the low use of interactive toys [3]. According to the National Institute for Education, there are differences associated with the equipment of kindergartens as well as different professional competencies, personal preparation and possibilities of individual teachers, leading to the need to increase digital literacy and professional competence of kindergarten teachers and their access to

technology (e.g. adequate equipment of kindergartens, Internet connection, etc.) [4].

2.1 Teacher in Preschool Education

Teacher is the one who guides the child on their journey of knowledge, awakens in them an active interest and desire to look around, listen and discover, not the one who tasks the child and controls the performance of these tasks. The teacher is tasked – their main task is to initiate appropriate activities, prepare the environment and offer the children opportunities to get to know, think and understand themselves and everything around them in an increasingly effective way.

The aim of the teacher's educational efforts is to support the pupil's development and intellect, speech and language, cognitive processes and functions, their feelings and will, as well as their self-concept and self-perception, creativity and self-expression, stimulate the acquisition and development of their educational skills and encourage them in further development, cognition and learning [5].

2.2 Digital (Pre)Literacy

Digital literacy is defined as a set of skills, knowledge, attitudes and values that an individual needs to use digital technology safely, confidently, critically and creatively at work, learning and in their free time and during their participation in social life. The Framework Educational Program for PSED in the Czech Republic (2018) does not contain the terms digital literacy and computational thinking and technologies used by children should complement their research and experimental activities (e.g. microscope, camera, etc.) and should serve as a diversification of the educational topic [6].

Preconditions are to be created within PSED for the later development of digital literacy, which we refer to as digital preliteracy. PSED aims to create a space for the child to learn about the initial digital competence. Preschoolers should gradually become acquainted with digital technology and find out what they are used for and what their purpose is. Practical experience may be, for example: the use of aids or devices commonly associated with everyday life (mobile phone, digital camera, etc.) or special aids to develop competence for learning, problem solving and activities (educational programs, smart toys, etc.) [7].

Today, the quality of education and its modernization is often discussed so that children can succeed in the dynamic and ever-changing world of the 21st century. Experts began to discuss in depth the topic of digital literacy, including building the foundations of digital preliteracy in PSED. The National Pedagogical Institute of the Czech Republic published the material Digital Literacy at the Focal Points of Education in 2020, which is a partial output of the Support for Teacher Work project and the Curriculum Innovation core task – Tasks Arising from the Digital Education Strategy of the National Institute for Education. This document contains sets of outputs in the

focal points of education for digital literacy and presents indicators defining the educational objectives that children and pupils should achieve in the individual stages of preschool and basic education in digital literacy. The indicators are formulated in the document so that it is possible to observe their achievement in all children and pupils. The mentioned document mentions three areas of digital competences (1. Man, Society and Digital Technology; 2. Digital Content Creation; 3. Information, Sharing and Communication in the Digital World) and brief descriptions of what a child should be able to implement and know in digital literacy at the end of PSED, e.g.: the child is aware of the importance of digital technology in everyday life, gets acquainted with the limits in use of digital technology, follows the rules of games, solves tasks, thinks creatively, presents possible procedures, captures facts from their surroundings, expresses their ideas using various methods, distinguishes some figurative symbols (pictograms, landmarks, icons, controls, etc.), acquaints themselves with communication options and shares tasks with another child [8].

According to the team led by L. Štašná [9] within the framework of digital preliteracy in PSED, it is possible to build the foundations for the development of all six sub-areas of digital competence, i.e.:

Area 1: Information and Data Literacy – Working with digital content (various images, symbols, icons). Children can work with programs/audio/video materials designed for the development of language and speech (e.g. sound memory, repetition of words) or for the development of mental operations, imagination and fantasy (e.g. search based on colour, shape, sounds, etc.).

Area 2: Communication and Collaboration – The use of devices commonly encountered (PC, mobile, etc.) to communicate with another person.

Area 3: Digital Content Creation – Children can capture reality and express their ideas using digital technology (e.g. painting with an interactive whiteboard or capturing activities with photography, photo collages, recording voice comments). Children can work with educational applications in which the content is completed or changed (e.g. painting, puzzles, electronic worksheets, etc.), they can also use programmable toys when playing.

Area 4: Security – Link between device protection, self-protection (focusing on personal data, health and well-being). Creating the foundations of safe work with digital technology.

Area 5: Problem Solving – Creative use of digital technology is possible to make activities in the field of art, music, movement, etc. more attractive.

Area 6: Technological Competences – It is not possible to develop computer networks and systems in the kindergarten environment, but children should be aware of

the technical environment of today's society (e.g. that a message can be written or a scanned image sent; they should know that the school communicates with parents via email, phone, that their kindergarten has a website, etc.).

3. Learning Based on Digital Play

Playful digital learning through a technological game platform aims to develop children's feeling of success by solving and overcoming challenges. Smart toys as an interactive medium provide opportunities for entertainment and learning. The IoToys is a concept referring to the connectivity of any device with the Internet. These smart toys are: Connected to online platforms via Wi-Fi and Bluetooth (or can be connected to other smart toys), the IoToys are equipped with sensors and are adapted to children's age. Here are the key terms associated with the IoToys:

Internet of Things (IoT) – A system of interconnected devices (e.g. smart toys, wearable devices, smart appliances, smart speakers, smart TVs) that are completely unique and have the ability to transmit data over a network without requiring data transfer between a person with computer.

Internet of Toys (IoToys) – Such toys can be robots, dolls, teddy bears and clocks, etc.; all have common devices for connecting to the Internet. Toys connected to the Internet can record several types of data that children play with and communicate with (such as sounds, pictures, movements, location). IoToys differ from Smart Toys and do not necessarily have to be considered smart. IoToys are a subcategory of the IoT.

Robotification – A process in which tasks commonly performed by humans are replaced by machines of some kind (they can be mechanical or electronic).

Datafication – A technological trend that makes data from many aspects of our lives.

Mobile App – A software application created especially for smartphones, tablets or other mobile devices. The creators of such applications usually try to make the most of the intuitive user interface and touch control that mobile devices offer.

Digital Play – Any form of involvement and participation of children with software/applications (on a desktop PC, iPad, smartphone, etc.). Participation of children with technology or virtual worlds.

Mobile Technology – Tablets, smartphones, electronic readers, MP3 players, etc.; technology is constantly expanding and evolving with tablets or laptops which are also considered mobile devices.

Digital Technology – Synonymous with information and communication technologies (ICT); include desktop

computers, mobile technologies, tablets, etc. Proper use of digital technology makes it possible to improve the efficiency and quality of teaching (this does not mean that they should replace a real teacher). Digital technology needs to be seen as tools to help teachers (or parents) and pupils achieve their goals [10].

ICT – Synonym of the terms 'computer' and 'digital technology'. Historically, the focus has been more on PCs, but has expanded to include interactive whiteboards and tablets; in addition to computer software, children have access to a range of products that incorporate some aspects of ICT, such as programmable interactive toys, digital cameras, which are recently immensely popular mobile technologies, especially tablets, among young children.

Science, Technology, Engineering, Arts, Mathematics (STEAM) – The attention of teachers and education professionals from each STEAM discipline seeks to find a way to increase the pupils' motivation and it is recommended to adapt it to real life and replace overly theoretical and isolated approach to teaching by interconnecting the subjects. STEAM emphasizes the combination of science, technology and arts. It is this mix that is important in the search for innovation. It should be noted that Arts do not have to be just visual, musical or dramatic art, it is also artistic design; we can also include Language Arts (i.e. language skills, such as the ability to formulate ideas and present them) [11].

3.1 Example of the IoToys: Furby

A typical example of the IoToys is the interesting Furby toy. Part of the playful use of the toy is the mobile 'Furby App' (see Fig. 1) which is compatible with both iOS and Android. (Furby can be also used without a mobile application as it is controlled by touch.) Furby is intended to stimulate children's imagination and a creative way of playfulness, empathy and encourages the children to interact with technology. Furby is an electronic toy that features a small furry creature with large ears and responds to light, sound, touch and other Furbies. Furby perceives the presence of a child, their movement and it can see with digital eyes, it can sing and share its feelings. Furby is not a classic toy as it requires the child to take care of it as well. The child recognizes various emotions, for example, if they annoy Furby by pulling its tail and feeding it chili peppers, it gets angry and the child has to appease their toy by playing with it and feeding it what it likes. There are many ways in which this toy perceives its surroundings. We place Furby in the category of robots which the child can control using voice commands and touches. To some extent, it resembles the once popular Tamagotchi animals, but pushes its interactive possibilities far beyond.

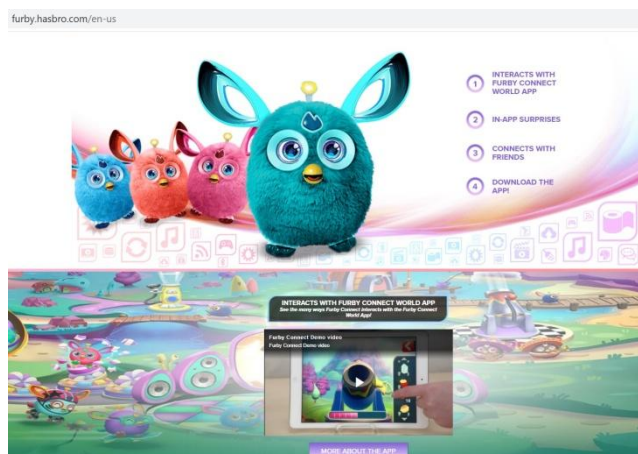


Figure 1: Hasbro Furby [12]

If we applied Furby to preschool education according to the sub-areas of digital competence listed in chapter 2.2, Digital (Pre)Literacy, the IoToys Furby could meet the following areas:

Information and Data Literacy – Through the Furby App the child works with digital content such as various symbols and icons that the App contains, at the same time it develops mental operations, imagination and fantasy in children which are further developed by playing with a plush Furby robot. The child can also perceive symbols thanks to the cartoon LED eyes expressing Furby's reactions. As for the Furby Boom mobile application, for example, it is a care game that is connected to Furby and the daily schedule includes games, feeding, cleaning and health care.

Communication and Collaboration – Through the Furby App the child uses a device (iPad or tablet) to communicate, also verbally communicates with Furby which responds to the child with its programmed emotions or so-called Furbish, which should motivate the child to communicate. Furby's second language is English, so the child learns to communicate naturally and playfully with Furby. The child may observe Furby's behaviour even when it comes into contact with other Furbies. Furby is an interactive toy that needs to communicate with the child and can change its personality during play, depending on how the child treats it. The more the child talks to Furby, the more its personality develops and the more Furby motivates the child to play more.

Security (Link between device protection, self-protection) – The child is explained how to work with an iPad or tablet, they develop the basics for secure work with digital technology, i.e. the child is explained that it is inappropriate to look at the screen for a long time or sleep with an iPad, the child understands the principles of working with a smart toy.

Problem Solving – Focused on the creative use of digital technology such as creating clothes or a house for Furby. It

is also possible to develop the ability of reflection and self-reflection. The child can record their voice and play music through Furby. Using Furby (also the Furby App), the child experiments creatively and develops their mental and social side. It would be appropriate if this type of IoToys was combined in collective games so that children in the whole group would be activated.

4. Conclusions

In the preschool age of the child, playing becomes the dominant activity and significantly affects personality development. The child's interaction with a robotic toy connected to a network, to a mobile application goes beyond traditional child's playing. It is a spatial game that is not limited and includes endless possibilities of virtual elements. Children playing with an IoToy can learn about a new kind of virtuality, engage in a kind of transmedia (sharing their stories) and develop their skills with digital technology which is becoming increasingly a part of many children's everyday life. The teacher in PSED can use the IoToys as a tool to support the child's cognitive abilities, imagination and fantasy, development of mental operations, e.g. to cultivate sensory perception and attention; to develop creative thinking, problem solving and creative self-expression. At the same time, through interactive toys such as the IoToys, the PSED teacher can strengthen the natural cognitive feelings in children, such as curiosity, interest and the joy of discovering. The IoToys can also be a tool for creating a positive attitude towards intellectual activities and towards learning, supporting and developing an interest in meaningful learning.

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CHANGES IN THE SELF-ASSESSMENT OF FUTURE TEACHERS AFTER SOCIAL-PSYCHOLOGICAL TRAINING

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Abstract: This paper presents the results of our research, the aim of which was to verify the impact of social-psychological training on the self-assessment of participants in a training program. The object of our investigation was a target group of future teachers, for whom we focused on cultivating their personality through the implementation of long-term social-psychological training. The research aimed to determine whether there is a statistically significant increase in the participants' self-esteem after completing the training of 110 hours. We used the Rosenberg Self-Evaluation Scale to monitor the level of self-assessment. In the experimental group that received the training, we observed statistically significant differences between the self-assessment before and after the training. We also measured statistically significant differences in self-assessment six months after completing the social-psychological training, suggesting the stability of these changes over time.

Keywords: social-psychological training, training programme, self-assessment, future teachers

1. Introduction

To achieve psychological satisfaction, a positive evaluation of one's person is essential. Self-evaluation plays the most crucial role in this process, and we perceive it as a specific component of self-image. Self-evaluation is a component of self-perception, and we understand it as an affective evaluation of one's importance and value [1]. It is essentially the result of social comparison based on self-observation [2]. Self-evaluation forms the emotional component of the self-system within which we make partial or general judgements about ourselves [3]. Self-evaluation forms the core of personality, expressing an attitude and determining the degree of confidence in one's abilities [4].

Nowadays, we believe it is necessary to develop healthy self-esteem in young people preparing for teaching. There is a lot of pressure on teachers today, they must fulfil higher requirements, and they often get in stressful and challenging life situations that can negatively affect their self-esteem, which reflects in their work. Many studies show that some teachers have either low self-esteem or, on the contrary, too high self-esteem. We believe that it is essential to pay attention to the development of healthy and stable self-esteem, especially in young people - future teachers, when their level of self-esteem is less stable than in later developmental periods. The training programmes focus on developing social competence, coping with stressful situations, solving conflicts, developing personal self-esteem, and deepening self-knowledge and knowledge of other people. For this reason, we consider these training programmes to be an appropriate form of developing a healthy and stable self-assessment, as the benefits of such oriented training programmes are pretty wide-ranging.

We intended to create a training programme for future teachers to develop social competence and then experimentally verify its effectiveness. Given the above

reasons, our research aimed to verify the influence of social-psychological training on the self-assessment of the trainees. We were also interested in how the trainees subjectively evaluate the training programme designed and applied by us.

We have therefore divided the stated objectives into two research areas. In the first area of research, we aimed to determine whether the level of self-assessment would increase after completing the social-psychological training in the training participants. Our participants were 2nd-year undergraduate students at the Master's level in the study programme of Teaching Psychology in combination with another subject. In the second area of research, we aimed to find out the subjective evaluation of social psychological training by the participants themselves.

We formulated the following hypothesis and research question for each research area:

The hypothesis for the first area of research:

H1: We suppose there will be a statistically significant increase in self-assessment among trainees after completing 110 hours of social-psychological training.

The research question for the second research area:

How do the participants subjectively evaluate the social-psychological training?

2. Research methodology

The research sample consisted of 19 participants of social-psychological training, namely 13 females and 6 males, aged from 22 to 25 years, studying the 2nd year of the Master's degree in the study programme of teaching psychology in combination with another subject at the Faculty of Education of the University of Constantine the

Philosopher in Nitra. Students participated in social-psychological training within the compulsory subject Social-psychological training, which is within their training programme curricula. The average age of the research sample was 23.74, and the largest group consisted of participants of social-psychological training at the age of 23 years.

Among the research methods, we used the Rosenberg Self-Esteem Scale and the modified Yalom's questionnaire.

The Rosenberg Self-Esteem Scale is a self-assessment scale used to determine the level of self-assessment [5]. This self-assessment scale is applicable from the age of 14 years for each developmental period, and there is no specific time to complete it [5]. We used the Rosenberg Self-Esteem Scale a total of three times, before the beginning of the social-psychological training, immediately after the training and with a six-month interval, in order to verify whether the social-psychological training has an impact on the self-assessment of the participants in the training programme and whether the measured changes will be stable over time.

After the completion of the social-psychological training, in addition to the Rosenberg Self-Assessment Scale, we administered a modified Yalom's questionnaire [6] to the participants in the training programme. With this questionnaire, we ascertained the impact and benefit of the training and group cohesion from the participants' perspective.

3. Research results

In the first area of research, we were interested in whether trainees' levels of self-assessment would increase after receiving long-term social-psychological training. To test the stated hypothesis, we used paired t-tests, comparing participants' self-evaluations before and after completing social-psychological training and self-evaluations before and six months after completing training.

We present the results of comparing the level of self-assessment of the training programme participants before completing the social-psychological training with their level of self-assessment immediately after its completion in Table 1 and Table 2.

Table 1 Paired t – test

Measurement 1	Measurement 2	t	df	p	Cohen's d
RSES sum1	RSES sum2	-2,26	18	0,04	-0,52

Table 2 Descriptive statistics

	N	M	SD	SE
RSES sum1	19	29,53	4,60	1,06
RSES sum2	19	31,79	5,97	1,37

Thus, based on Table 1 above, we can conclude statistically significant differences between the self-assessment before and after the social-psychological training, as the p-value was 0.04 ($t = -2.26$). We can observe statistically significant differences between the self-evaluation before and after the training also in Table 2. The mean value of the participants' self-evaluation before the training was 29.53, and after the training, the mean value of the self-evaluation of the trainees was 31.79, i.e., the self-evaluation of the future teachers increased by an average value of 2.26.

We could see changes in participants' self-assessment when comparing the self-assessment before the social-psychological training with the self-assessment half a year after the end of the training programme. Based on the results, we can see statistically significant differences between the self-assessment before the training and half a year after its completion, as the p-value we found was 0.04 ($t = -2.22$). We can also notice the differences mentioned above in the mean values of the self-assessment of the training group. Before the training, the average value of self-assessment of the training group was 29.53 and the value of self-assessment half a year after the social-psychological training was 31.63, i.e. the self-assessment of the training group increased on average by the value of 2.10. We present the results of comparing self-assessment before and half a year after the training in Table 3 and Table 4.

Table 3 Paired t – test

Measurement 1	Measurement 3	t	df	p	Cohen's d
RSES sum1	RSES sum3	-2,22	18	0,04	-0,51

Table 4 Descriptive statistics

	N	M	SD	SE
RSES sum1	19	29,53	4,60	1,06
RSES sum2	19	31,63	6,07	1,39

Based on the above results, we accept Hypothesis 1, as there was a statistically significant increase in self-evaluation among students preparing for the teaching profession after receiving social-psychological training.

In the second area of research, we were interested in how the training group participants subjectively evaluated the social-psychological training, so we had the training group members complete a 60-item modified Yalom's questionnaire, which we summarized in the following Table 5:

Table 5 Evaluation of the Yalom's questionnaire

Questions	N	min.	max.	M
60	19	1,08	4,87	2,98

According to the results shown in Table 5, we can conclude that the lowest mean value was 1.08, and the highest mean value in the questionnaire was 4.87. Participants subjectively rated the social-psychological training as useful ($M=2.98$). The participants' subjective evaluation of the social-psychological training reinforced the results we obtained by the Rosenberg self-esteem scale measurements before, after, and six months after the social-psychological training. We observed a statistically significant increase in the participants' self-assessment.

4. Discussion and conclusion

In the first research area, we were interested in whether there is a statistically significant increase in self-evaluation among trainees after completing social-psychological training. Therefore, we formulated a hypothesis for the first research area in which we hypothesized that there would be a statistically significant increase in self-assessment after completing social-psychological training. Based on the results, we accepted our hypothesis as we observed a statistically significant increase in self-assessment among the trainees through the Rosenberg Self-Assessment Scale ($p=0.04$). We observed a statistically significant increase in participants' self-assessment immediately after the social-psychological training and half a year after completion. Through the statistical analysis, we repeatedly observed a statistically significant increase in the self-assessment of the trainees compared to their level before the completion of the social-psychological training ($p=0.04$).

Our findings within the first research area are consistent with the results of other research studies. For example, Schuller, Gereková [7], Gereková, Schuller [8] also noted an increase in self-esteem in trainees after receiving social-psychological training, especially in female trainees, and their research sample consisted of university students. As in our case, the social-psychological training focused mainly on self-knowledge, and the techniques and various other exercises aimed at deepening self-knowledge in the trainees may have resulted in a significant increase in the trainees' self-assessment.

Similarly, Macková [9] was also interested in whether the training programme would positively impact the participants' self-assessment. They were future teachers of music education. Macková [9] had an experimental and a control group in her research, and she observed a statistically very significant increase in the participants' overall self-assessment after completing the training programme. In the experimental group, she observed an increase in perceiving their self-value due to the completion of the training programme. On the contrary, in the control group, where the training program was not applied, there were no differences in self-assessment compared to the first measurement [9].

Among foreign authors, statistically significant increases in self-assessment were observed in trainees after completing training programmes, e.g., Lin, Shiah, Chang,

Lai, Wang, Chou [10], Yadav, Iqbal [11], Maryam, Davoudi, Zahra, Somayeh [12], Vatankhah, Daryabari, Ghadami, Naderifar [13], Shin, Kim [14], Mishal [15], Sudhakar, Sharma [16], Parray, Kumar, David [17], Malik, Varghese [18]. These authors focused on different age groups, mostly university students when examining the impact of training programmes.

More statistically significant results were reported by Maryam, Davoudi, Zahra, Somayeh [12], who applied a social skills training programme to a sample of high school students who showed statistically significant increases in self-evaluations ($p < 0.001$) after completing a social skills training programme. This training programme consisted of 10 sessions, twice a week, and one session lasting 50 minutes. Yadav, Iqbal [11], also arrived at the same conclusion when conducting a life skills training programme with adolescents. Based on their findings, they concluded the study by stating that if adolescents develop their life skills, they will subsequently have a more positive self-evaluation as group learning provides a space for social skills development through social interaction, promoting self-evaluation in the members of the training programme.

Thus, based on our findings and the reviewed research on the impact of training programmes on self-esteem, we can say that training programmes are beneficial for increasing self-esteem not only in adolescents, who are in a susceptible period in terms of self-esteem development but also in elementary school students and university students. Based on our results and study of the literature, we can conclude that social-psychological training positively impacts the self-assessment of the training group participants.

In our research, we register several limitations, and we believe that correcting them could move the results to a higher level. Given the unfavourable pandemic situation, the experience of trainees concerning the coronavirus could also have influenced our results. This pandemic situation in Slovakia also limited the size of our research sample, as we originally planned to investigate the impact of social-psychological training in several training groups. For this reason, we cannot generalize the results of our research to a broader population. Another limitation was that we did not have the opportunity to conduct self-assessment measurements with training participants more than half a year apart. Therefore, we lost the opportunity to observe the stability of changes in trainees' self-assessment over a longer time interval. The bad pandemic situation in Slovakia caused a delay in implementing the social-psychological training, which negatively affected our original timetable, within which we had also originally planned to implement the social-psychological training. Initially, this social-psychological training should have had the same amount of training hours, but its duration should have been longer and in the form of regular shorter meetings. Our goal for the future is to implement this measurement to verify that the statistically significant

changes we found after the training programme are still present.

Based on our research findings, we believe it is crucial to develop self-assessment in future teachers to a greater extent, which will be, subsequently, reflected in their behaviour and performance as teachers. Thus, we venture to suggest that the development of healthy and stable self-esteem in individuals can be achieved precisely through training programmes implemented over a long period in the form of frequent and regular meetings. These programmes focus on deepening self-knowledge and knowledge of other people, developing social competencies, developing self-esteem, and coping with the various challenging and stressful situations that teachers face every day.

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QUANTITATIVE PEDAGOGICAL RESEARCH OF THE EFFECTIVENESS OF THE SCHOOL MEASURING

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Abstract: In this paper, the author compares the results of the research, which was realized with the measuring system at the grammar school. As a research method, we chose a didactic experiment. The research sample, high school students, were divided into experimental and control group. In the experimental group, the researcher taught with a measuring system, in the control group, the teaching took place in the classic way. Before the teaching, students of both groups completed a pretest, which determined the level of knowledge and skills of both groups. After completing the class, students completed a posttest. Based on the results of the posttest and pretest, we determined the effectiveness of teaching with a measuring system.

Keywords: pedagogical experiment, capacitor, measurement system

1. Introduction

The use of a measuring system during the teaching of physics is attractive for students, as they actively use technology in everyday life. Teaching with a measuring system provides a number of advantages compared to classical teaching. Students have the opportunity to work with real data, verify theoretical knowledge in practice and, last but not least, the development of interdisciplinary relationships. The measuring system was used in teaching electrical circuits and capacitors in the subject of high school physics. To measure the capacitor capacity by the indirect method, a very fast voltage and time measurement is often required. With a classic voltmeter, the measurement is difficult and often the measurement is practically impossible. The measuring system significantly simplifies the voltage measurement and at the same time allows to display the measured data in the form of graphs in real time.

2. Curriculum

According to the ISCED 3A state physics curriculum [1], the aim is to develop students' skills in data processing and experiment implementation. High school students should be able to evaluate data in a variety of ways, work with graphs, tables, and make data-based predictions. Within the target requirements for knowledge and skills of high school graduates in physics [2], grammar school students should know define the value of the conductor and capacitor capacity and derive a unit of capacity from the definition formula. Students should know, how to charge the capacitor and compare the capacitances of the capacitors by discharging them through the bulb. Students should know how to apply formulas for energy of electric field of a charged capacitor when solving tasks. Part of the preparation is also an experimental activity in which students should be able to connect capacitors in series and in parallel. Based on these requirements, it would be appropriate to implement work with a capacitor, either during classical lessons or laboratory tasks for high school graduates in physics. The capacitor can also be used as an interesting "physics toy" for primary school students (e.g.,

a circuit with a capacitor charge supplies a light emitting diode for a while, which lights up for a while) [3]. With the measuring system it is possible to demonstrate a transient phenomenon in the RC circuit, which can be characterized as: "a steep time rise in voltage on the capacitor and subsequent with a rapid attenuation to the value of the source voltage" [4].

3. Theory

The basic idea of a capacitor is that it is a component that stores an electric charge and can be used as a temporary voltage source. The voltage formula applies during capacitor charging:

$$U_c = U_0(1 - e^{-t/RC})$$

where U_c is voltage drop, U_0 is the supply voltage, t is the time, R is the resistance of the resistor in series and C is capacitance of the capacitor. The following formula applies when discharging a capacitor:

$$U_c = U_0 e^{-t/RC}$$

An important parameter of the RC circuit is the so-called time constant τ :

$$\tau = RC$$

This time constant determines the character of the RC circuit. Circuits with a small value of the time constant have a fast and steep rise, circuits with a large time constant are characterized by a slow rise in voltage and current. The time constant has the dimension of time, and its value is equal to the time during which the voltage rises to 63.2% (or the current drops to 36.8%) of its original value. The capacitor is charged / discharged after 5 times the time constant [4].

4. Research

The main goal of the research was to verify the effectiveness of the measuring system in teaching the capacity of capacitors during physics lessons. The

researcher's task was to compare students' results using a measuring system. Two groups of students were compared: an experimental group, which used a measuring system, and a control group, which did not use a measuring system. Based on the goals, we developed research questions:

- What is the level of memorization of physics content for experimental and control group?
- What is the difference in skills when working with data and graphs for experimental and control group?
- What is the difference in the application of acquired knowledge for experimental and control group?

Based on research questions, we formulated hypotheses, which we verified with the help of pedagogical research:

- Hypothesis 1: The use of measuring system during the teaching will increase the level of memorization of experimental group.
- Hypothesis 2: The use of measuring system during the teaching will increase the level of skills of experimental group in working with graphs and data.
- Hypothesis 3: The use of measuring system during the teaching will increase the level of application of acquired knowledge in solving physics problems for experimental group.

4.1 Research methodology

To verify hypotheses 1 - 3 in practice, we used a pedagogical quasi-experiment as a research method. A quasi-experiment is a research method in which the researcher was unable to select respondents at random [5]. The research sample consisted of 64 students. The lessons took place in two ways:

- teaching in the experimental group. In this group, the researcher, as a teacher, implemented a measurement system in the teaching. The teaching included a demonstration experiment carried out by a researcher.
- teaching in the control group. The control group continued lesson in the classical way without a measuring system.

The task of the researcher was teaching of physics and carry out research with pedagogical quasi-experiment in grammar school. The quasi-experiment method included pretest (input test) and posttest (output test) for both groups. At the end of the research, the researcher processed the acquired data using statistical tools. In both groups was the name of the topic: "Serial and parallel connection of capacitors". The curriculum included knowledge about connecting capacitors, charging and discharging capacitors. As part of the teaching in the experimental group, the researcher used a measuring system in the role of a teacher.

4.2 Pretest

Before teaching, we presented a pretest to both groups. Students had to answer 4 questions in the entrance test,

which were aimed at finding out and comparing the level of input knowledge and the level of application in solving physical problems:

1. What is the basic unit of a physical quantity of electrical capacity?

In this question, we determined the level of basic knowledge of students. Students either answered with the whole word *Farad* or *F*. Sporadically, answer C also appeared, which can be attributed to the inattention of reading the question.

2. What applies to the capacitance C of the plate capacitor? Apply the relation in the note to find the correct answer, where S is the content of the effective area of the plates, and d is the distance of the plates. The permittivity of the environment is ϵ ?

Note: $C = \epsilon S / d$.

In this task, the students had 4 options, of which the correct answer was C:

- A. If we reduce the plate distance twice, the capacitor capacity will be reduced twice.
- B. If we increase the content of the effective area of the plates twice, the capacity of the capacitor will decrease twice.
- C. The capacity of the capacitor does not change if we double the distance between the plates and at the same time double the effective area of the plates.
- D. The capacitor capacity does not change if we change only the geometric properties of the capacitor.

Students had a formula at their disposal, which made it easier to choose the right answer. Thus, students could apply mathematical skills in working with the formula. Answer A is incorrect because as the distance decreases, the capacity increases. Answer B is incorrect because if we increase the effective area of the capacitor, the capacity will increase. Answer D is incorrect, because changing the geometric properties of the capacitor will change the capacity. Answer C is correct, because with increased distance, the capacity does not change if we increase the active area content.

3. To the capacitor in an unknown el. circuit we connected a parallel voltmeter. We measured the voltage values on the capacitor with a voltmeter. We wrote the voltage values in the table every second:

Table 1 Measuring of voltage

Time [seconds]	0	1	2	3	4	5
Voltage [Volts]	5.2	1.5	0.7	0.3	0.1	0

After the measurement, we disconnected the voltmeter from the capacitor. At the end of the measurement, the capacitor was:

- A. charged
- B. the state of the capacitor cannot be determined based on the voltage on the capacitor
- C. discharged
- D. the state of the capacitor can be determined only by measuring the current in the circuit

Students in this task worked with a spreadsheet. They could come up with a solution intuitively, or with the knowledge that a discharged capacitor does not carry any electric charge, and thus there can be no potential difference on the capacitor. Since at the end of the measurement, at 5 seconds, the voltage was zero, the capacitor was discharged, so the correct answer is option C. Options B and D are logically incorrect, because by measuring the voltage we can determine the state of the capacitor. Option A is non-intuitive, as a voltage value of 0 volts should evoke in students the knowledge that the total electric charge that accumulates on the capacitor plates is zero.

4. We can graphically represent the work with the content of the hatched part below the graph (Figure 1). Which of the graphs corresponds to the work during charging to the charge Q to the voltage U ? To evaluate the graphs, use the relation for the total work W in charging the capacitor $W = (QU)/2$.

Students had to choose the right graph, working with the relation $W = (QU)/2$. This task involves the application of knowledge, that area under the graph (dependence of the electric charge Q on the voltage U) is equal to the total work W . Based on this finding, students could rule out the answer C. The hatched content is equal to $S = QU$, which is excluded from the relationship for capacitor charging work.

During capacitor charging, the voltage is directly proportional to the total electric charge. This knowledge excludes options A, C, D, in which the graphs show a constant or decreasing course of the electric charge. The correct answer is option B. The content of the hatched pattern corresponds to the relationship for the overall work and at the same time with increasing voltage, the electric charge also increases.

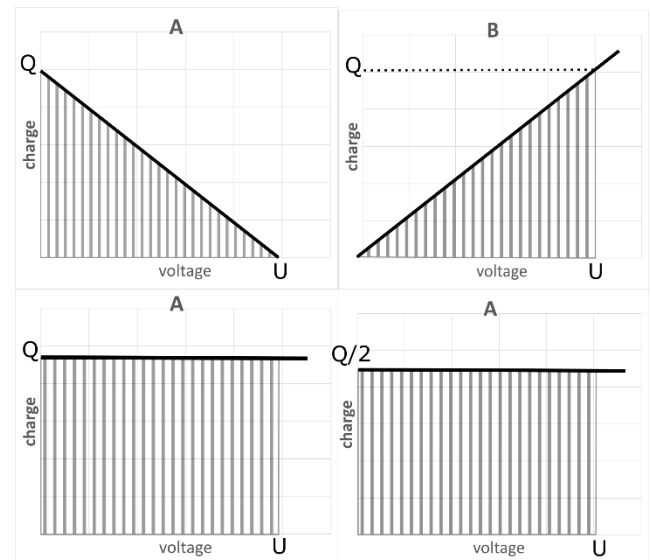


Figure 1: Graphs for question 4

4.3 Posttest

After the lessons, students of the experimental and control group solved an output test with 4 questions:

1. The capacitors in the picture are connected:

- A. Serial
- B. Parallel
- C. in parallel and also in series

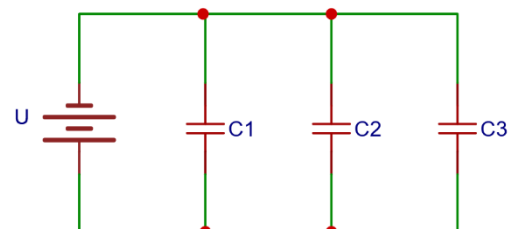


Figure 2: Scheme of connected capacitors

Students had to work with the circuit diagram of 3 capacitors in this question. We therefore examined the level of application of the students' learned knowledge, as the content of the curriculum was a diagram and, in the case of an experimental group, a practical demonstration of serial and parallel connection of capacitors. The correct answer is option B.

2. Write a relation for calculating the total capacity of capacitors connected in series?

This question focuses on the level of memorization of students, as the relationship for the total capacity of the 2 capacitors connected in series was part of the curriculum:

$$1/C = 1/C_1 + 1/C_2$$

where C is the total capacitance, C_1 is the capacitance of the 1st capacitor and C_2 is the capacitance of the 2nd capacitor.

3. We connected a capacitor with a capacity of $C1$ to the circuit and measured the time it takes to charge. Subsequently, we replaced the capacitor with another with a capacity of $C2$. This is how we performed measurements for 5 different capacitors. Which of the capacitors has the largest capacity?

Table 2 Measuring of time

Capacitor	$C1$	$C2$	$C3$	$C4$	$C5$
Time [seconds]	4.96	2.9	2.98	4.961	1

In this task it was a matter of applying the proportions between the time t for which the capacitor is charged and its capacitance C :

$$t \sim C$$

The students' task was to choose the capacitor that had the longest time. Inattentive students, possibly less skilled in mathematics, could choose the wrong capacitor $C1$. The correct answer is capacitor $C4$.

4. In the picture we have 2 different graphs corresponding to 2 different measurements with capacitors. Which of the graphs corresponds to the measurement: we connected the capacitors connected in parallel to the circuit and started the measurement. We charged capacitors to the supply voltage. Then capacitors were discharged to zero voltage. Finally, we disconnected one capacitor and repeated the measurement (charging and discharging process).

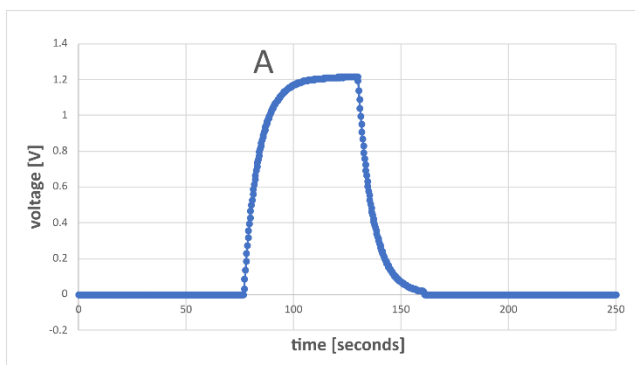


Figure 3: Graph A

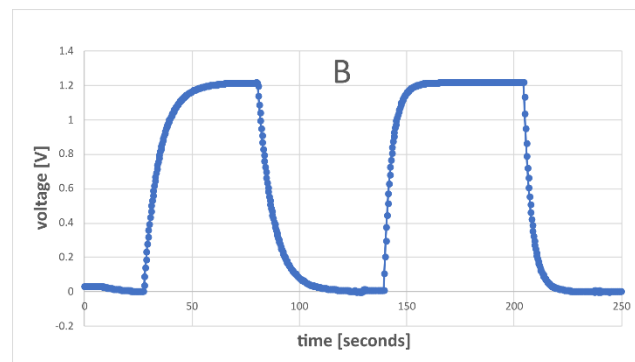


Figure 4: Graph B

Correct answer is option B, as 2 curves correspond with 2 different measurements.

5. Research results

Each question was assigned 1 point for the correct answer. We therefore assigned a pretest and posttest score to each respondent. We used student t - test for experimental and control group to process the obtained data.

The experimental group gained an average of 3.32 points in the pretest, and an average of 3.97 points in the posttest. The control group gained an average of 3.15 points in the pretest, and an average of 3.3 points in the posttest. The experimental group improved by 0.65 points, while the control group improved by only 0.15 points. For both groups, we determined the level of significance of p using a t-test. If the level value is less than 0.05, we consider the difference between posttest and pretest to be statistically significant. Statistical analysis using t - test found a statistically significant difference between pretest and posttest in the experimental group ($p < 0.05$), while the difference for the control group was insignificant ($p > 0.05$).

Table 3 Results of experimental and control group

	N	pretest	posttest	difference	p
Experimental group	31	3.32	3.97	0.65	0.002
Control group	33	3.15	3.3	0.15	0.232

The research confirmed the effectiveness of the use of the measuring system during the teaching of physics at the grammar school. Based on the t-test and the obtained parameters of the significance level for the experimental group, we verified the validity of hypotheses H1 - H3.

6. Conclusions

In this article, we analyzed the effectiveness of using the measurement system in teaching physics. Based on the results of the pedagogical experiment, the experimental group achieved a statistically significant difference in pretest and posttest. Based on research, we can consider teaching physics with a measuring system to be more effective compared to classical teaching of physics.

Working with a measuring system develops several levels of thought operations in the student, especially the understanding and application of acquired knowledge.

Acknowledgements

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DETECTION OF MUTUAL CONNECTIONS AND DIFFERENCES BETWEEN THE FIRST AND THE SECOND YEAR SECONDARY SCHOOLS' STUDENTS IN THE LEVEL OF EMPATHY AND ATTACHMENT

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Abstract: *The study aims to identify the mutual connection between empathy and attachment. The research sample consists of 240 secondary schools' students. The participants' age range from 15 to 16 years. We used a non-standardized questionnaire Empathy Quotient- EQ to determine the level of empathy, and a standardized questionnaire Parental Bonding Instrument- PBI to determine the types of attachment. We identified a statistically significant correlation between the level of empathy and the type of attachment and that there was no difference between boys and girls in the level of empathy.*

Keywords: *empathy, attachment, mutual connections, differences, gender*

1. Introduction

The adolescence is important part of individual's life in shaping his relationships and feelings [3]. Research found that it is the most challenging part of human life in upbringing because the individual has increased emotionality [12]. Empathy means for a person the ability to behave appropriately and manage everyday situations [8]. We can say that empathy is in many ways the opposite of aggressive behavior and aggression [14]. J. Bowlby was the first to deal with the importance of an attachment for the emotional development of an individual [14]. The lack of a supportive and receptive environment is associated with poorer well-being and maladaptive forms of behavior [4]. Research [1,7] found that early attachment to parents affects the creating an image of oneself as well as of others. Furthermore, research [15,7] found that parents are important for the adolescent's own self-esteem and that gradual independence from the family is characteristic of this period. Family relationships are protective and at the same time risk factors that are related to self-awareness and maladaptivity of adolescent functioning [15]. The adolescent's behavior gradually becomes autonomous, it is very important to realize that this does not mean the loss of the meaning of the relationship, but it is a manifestation of the context of development [7]. Attachment to parents is an important factor in an adolescent's life because it affects his development, functioning in relationships, and in the perception of himself and others. Empathy helps to understand the interpersonal adaptation of a person to the environment. The basic level of empathy is essential in interpersonal relationships [17]. According to some authors, girls scored higher in characteristic empathy factors than boys [10].

The main aim of the research is to find out whether there is a connection between the attachment and the overall level of empathy in adolescents. The partial goals of research are to find out whether there are differences in the level of empathy in girls and boys. Based on the research studies [4,10] we formulated two research questions.

RQ1: Is there a statistically significant connection between empathy and attachment?

The connection between empathy and attachment was studied by many researchers. Research [10] confirmed that in boys, empathy was an important factor in the relationship between the mother providing care and the environment.

RQ2: Are there a statistically significant differences between boys and girls in the level of empathy?

Research [10] confirmed that girls scored higher in specific factors of empathy than boys. Equally important result of their research was that girls and women better understand, recognize, and regulate emotions than boys. Based on these facts, we expect that gender is related with predictable variables such as attachment and empathy.

2. Method

2.1 Research sample

The research sample consisted of 240 (100%) participants, selected for the research through deliberate selection. Of these, 120 (50%) were boys and 120 (50%) were girls. Our research sample consisted of participants who had the status of a secondary school student and were in the age range of 15-16 years. Part of a research sample consists of students from the Grammar school or Secondary Industrial School. Students were comparable in terms of age, school level, socioeconomic status, and family integrity. All participants participated in our research voluntarily and anonymously by filling in a battery of questionnaires.

Table 1 Research sample- gender

<i>Gender</i>	<i>Number</i>
Female	120
Male	120
Total	240

Table 2 Research sample- school

Name of School	Number
GAM	64
SPS	72
GCM	94
GEJH	10
Total	240

2.2 Materials and equipment

We used two questionnaire methods during research, namely the Empathy Quotient EQ questionnaire and the PBI questionnaire to explore the established research questions. The first method used was the Empathy Quotient (EQ) which consists of 60 items. 20 items are intended to distract the individual from a persistent focus on empathy and the remaining 40 items are used to determine the level of empathy. The items are evaluated on a 4-point Likert scale. The EQ questionnaire measures cognitive and affective aspects of empathy [9]. The Cronbach α coefficient as the scale internal consistency indicator for EQ was $\alpha = 0.835$ which is consistent with the value reported in the original tests [9,13].

As a second questionnaire, we used Parental Bonding Instrument (PBI) which was developed based on previous research by Roe and Seligman (1963). The PBI comprises two factorially-derived scales: Care and (Over)-Protection. The Care factor is bipolar and involves one pole defined by affection, empathy, emotional warmth and closeness, and the other pole by emotional coldness, neglect, and indifference. The (Over)-Protection factor has one pole defined by control, intrusion, overprotection, infantilization, excessive contact and prevention of independent behaviour, and another pole defined by items reflecting allowance of independence and autonomy [1]. Father and mother are evaluated separately on two 4-point scales. This questionnaire is a Czech adaptation of the questionnaire by G. Parker, H. Tupling and L. B. Brown (1979) [11]. In the research, the Cronbach alpha coefficient rate was $\alpha = 0.821$.

2.3 Procedure

The data gathering was executed during March 2020. We then evaluated the data. To evaluate the obtained data, we used the statistical program SPSS 20 (Statistical Package for Social Science) for Windows, in which we processed and analyzed the data using several tests: Boxplot, Kolmogorov-Smirnov test, ANOVA, Leven test, and T-test.

3. Results

The index of qualitative variance for gender is almost 100%, which means a balanced sample, for the variable PBI mother it is 93% and for the variable PBI father it is 91%. The empathy score is only cardinal variable in research. We therefore decided to calculate the coefficient of variation, which has a value of 26%, which means a relatively homogeneous result. Firstly, we performed normality testing for the variable- empathy. Using

Boxplot, we identified extreme values that we excluded from the research.

Table 3 Normality test for empathy

	N	Average	Med.	Standard deviation	Skewness	Kurtosis	Sig.
Empathy	240	38.6	40	9.522	-0.34	-0.188	0.10

In table 3 we can see the descriptive values of the variable- Empathy as well as the results of the Kolmogorov-Smirnov test. The mean and median values are not very different from each other, indicating a normal data distribution. As well as the value of the skewness and kurtosis are in the typical range from -1 to 1, so we can say that there is a normal distribution in research. The decisive factor for normal distribution of data is the significance, which is higher than 0.05 ($p = 0.1$). This confirmed that in research is normal distribution of data.

Table 4 Normality test for empathy (mother)

PBI Mother		Kolmogorov-Smirnov test		
		Test value	Degrees of freedom	Sig.
Empathy	Affectionate constraint	0.109	38	0.200*
	Affectionless control	0.116	27	0.200*
	Optimal parenting	0.084	39	0.200*
	Neglectful parenting	0.241	8	0.190

Table 4 Normality test for empathy (father)

PBI Father		Kolmogorov-Smirnov test		
		Test value	Degrees of freedom	Sig.
Empathy	Affectionate constraint	0.158	16	0.200*
	Affectionless control	0.144	22	0.200*
	Optimal parenting	0.098	51	0.200*
	Neglectful parenting	0.143	18	0.200*

Due to the nature of the research questions, we tested normality in each of the selections for the variable- empathy within the mother and father PBI groups. In all cases, the significance value was higher than 0.05, thus we confirmed the normal distribution of data for the empathy variable in each of our selections. The next step was to analyze the data.

RQ1: Is there a statistically significant connection between empathy and attachment?

Table 5 Descriptive statistics

Type of attachment = PBI Mother	N	Average	Standard deviation
Affectionate constraint	76	39.68	8.406
Affectionless control	54	33.52	9.835

Optimal parenting	78	42.00	8.721
Neglectful parenting	16	33.63	10.239

In the first research question, we examined the connection between the score in the empathy and the type of attachment. At first we present table no.5, which has a descriptive character. It represents the number of observations within each selection as well as the average score values achieved in the group.

Table 6 Levene's test

	Test value	Sig.
Empathy	0.875	0.456

The next table (table 6) represents Leven's test of homogeneity of variance, which tests another assumption of ANOVA. As the significance value is higher than 0.05 (sig = 0.456), it was confirmed that the homogeneity of variance is maintained across all selections.

Table 7 ANOVA

F	Sig.	Effect size
5.719	0.001	0.137

In table 7 we can see the result of ANOVA test, which is a parametric test used to compare 3 or more groups. In the table we see that the significance value at the statistical value of the test $F = 5.719$ is less than 0.05 (sig = 0.001). This means that there is a statistically significant difference between groups within empathy and thus we can say that there is a statistically significant connections between the type of attachment to mother and the level of empathy. The effect size was 0.137, indicating a large effect.

Table 8 Descriptive statistics

Type of attachment = PBI Father	N	Average	Standard deviation
Affectionate constraint	32	39.31	9.931
Affectionless control	44	33.59	9.816
Optimal parenting	102	40.24	9.099
Neglectful parenting	36	40.61	9.287

In table 8, we can see descriptive statistics. The highest score was achieved by neglecting parenting by the father, followed immediately by optimal parenting.

Table 9 Levene's test

	Test value	Sig.
Empathy	0.531	0.662

Based on the values of the Leven test, we again conclude that the homogeneity of the variance was maintained across all groups.

Table 10 ANOVA

F	Sig.	Effect size
2.885	0.039	0.078

As we can see in table 10 there is a statistically significant connection (sig = 0.039) between the level of empathy and the type of attachment to father. The effect size was 0.078, indicating a medium effect.

RQ2: Are there a statistically significant differences between boys and girls in the level of empathy?

Table 11 T-test for two independent samples

		N	Average	Standard deviation	t	Degrees of freedom	Sig.
Empathy	Boys	120	37.72	9.910	-1.052	111	0.295
	Girls	120	38.86				

In table 11 we can see the results of a T-test for two independent samples. As we can see, the values of the mean do not differ relatively, as well as the value of significance is higher than 0.05 at 111 degrees of freedom (sig = 0.295), so we can say that there is no statistically significant difference between group of boys and group of girls in the level of empathy.

4. Discussion

4.1 Interpretation of results

The main aim was to explore the mutual connections between empathy and attachment in adolescents. We also explored whether there is a difference between boys and girls in the level of empathy, and it is important which of the parents has a stronger effect on the level of empathy of the student.

In the first research question, we examined whether the attachment is a strong factor that affects the level of empathy in young people. This connection has been investigated in another studies [4,10]. They found that in boys, empathy was an important factor in the relationship between the mother providing care and the environment. Our results confirmed the existence of a connection between attachment and the level of empathy. This means that the upbringing is a strong determinant of the level of empathy in young people, because it is parents who have a positive or negative effect on stimulating empathy [12]. In the research we worked with adolescents, so our findings can be interpreted depending on age. It is characteristic of this period that individuals have a level of empathy, which is transformed into the first partnerships [19]. Our findings support research [4,10] which found that most students with a positive type of attachment had a high level of empathy. Furthermore, the research [4], found that

adolescents with a high level of protection and a low level of control showed fewer psychiatric symptoms. These adolescents had a positive sense of satisfaction and felt supported by family and friends. On the other hand, the combination of low care and high control increased the risk of psychiatric symptoms and lower support, which means that their parents did not show as much interest in them as they would like. These individuals also experienced a lack of support from people around them. This aspect also had a negative effect on the level of children's empathy [4]. We also found a significant attachment to father to the boys and to the girls.

In the second research question, we examined whether there is a difference between boys and girls in the level of empathy. Research [4] has found that girls are much more empathetic than boys and can more easily recognize their own emotions and the emotions of others. We found that there is no difference in the degree of empathy between boys and girls. The results of the research question are not in line with previous findings. This could be due to the age category of the participants, due to the input of factors such as upbringing and personality characteristics, but also the non-standardization of the questionnaire for our population, as this is research conducted abroad and therefore, we did not notice differences. The fact that we did not notice any differences can also be determined by the attachment itself [6] or by the environment in which the students move [16]. Some research [10, 18] point to the fact that girls are better at understanding others and more able to recognize and regulate emotions than boys.

4.2 Limits

We revealed several limits of research, and one of them may be the kind of selection. Our research sample consisted of participants who were deliberately selected. By deliberate selection, the degree of generalization to the entire population decreases, as we worked with only a certain part of the sample. A very strong factor can also be the attunement of the whole group of students who filled in the questionnaires, their mental state, as well as the level of their self-assessment, which is demonstrated on a self-assessment scale.

We consider one of the more serious limits to be that we did not meet the respondents in person, which could have negatively affected the data obtained, because we could not notice the variables that were on their side.

The self-assessment method can also be considered as a limit. It would be appropriate for us to focus on performance tests or evaluation by others, which would make it possible to largely eliminate shortcomings. Distortions could also be caused by the fact that the respondents did not understand the questions posed or could not answer them and randomly chose one of the possible answers. They might even find it irrelevant to answer some questions.

As another limit, we can also expect a misunderstanding of the assignment, or dishonest answers in the rating scales and to the questions that were in the questionnaire.

4.3 Practical application and future intentions

In future research we would expand the research with a life satisfaction questionnaire. We could explore the connection between level of empathy and life satisfaction [8, 9]. Based on the results of presented research, we can say that 1st and 2nd year secondary school students have a high level of empathy and attachment. The results of the research also pointed to the occurrence of empathy in secondary school students. It would be appropriate to verify the research questions used in the research by means of a cross-sectional study, which could be established in practice in relation to a specific development period. It is very important to be aware of the importance of the attachment, which is an important factor that has a great impact on the subsequent development of the individual and his functioning in society. Communication, trust, understanding, love are very important factors in building healthy relationships, so we would like to include them in future research.

Acknowledgements

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INTEGRATING COLLECTED LABOR MARKET MATERIALS INTO THE EDUCATION: STUDENTS OPINION

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Abstract: This paper contains couple of suggestions for institutions providing training as administrative officer through experience gained in southern Slovakia, where according to the Act No. 204/2011 Coll., which amends and supplements Act No. 184/1999 Coll. on the Use of Languages of National Minorities the Hungarian minority language can be used during the administration. It details how the practices of the current administrative labor market can be integrated into the higher-level education. The method of the research: i) teaching couple of courses based on labor market experience, ii) filling questionnaire with students from the test group. The method is tested at the Constantine the Philosopher University in Nitra, at study program called Hungarian-Slovak Bilingual Mediator at the Faculty of Central European Studies. This study program provides education to the field of administration mainly to southern Slovakia, where beside the Slovak language the Hungarian language can be used as well during the administration.

Keywords: administrative officer, practice-oriented education, labor market, education

1. Introduction

In the Slovak Republic Act No. 204/2011 Coll., which amends and supplements Act No. 184/1999 Coll. on the Use of Languages of National Minorities ^[1], regulates the use of minority languages in official communication. According to this act, the Hungarian language, as a minority language can be used in municipalities, where at least 20% of the municipal population is made up of this national minority. Currently there are 512 such municipalities in South Slovakia where this applies.

The incomplete terminological knowledge of the employees' does not facilitate the efficient administration of the clients in the language of minority. This is also proven by The Report on the Use National Minority Language in the Territory of the Slovak Republic for the period 2017-2018 ^[2]. Because of this, it is really important to educate multilingual administrative workers, who efficiently speak Hungarian and Slovak business language as well.

The Hungarian-Slovak Bilingual Mediator study program provides training for professionals in the field of bilingualism especially to those regions of Slovakia where the use of the Hungarian minority language is permitted. It aims to develop competencies in the official contact process not only in Hungarian, but Slovak and English language as well. Basic legal, economic, computer science and social science knowledge education is also part of the study program. ^[3]

One of my previous research within 504 questionnaires from BA (425) and MA (79) students were analyzed, has pointed out that students would like to find a job after their studies even at the BA level. ^[4]

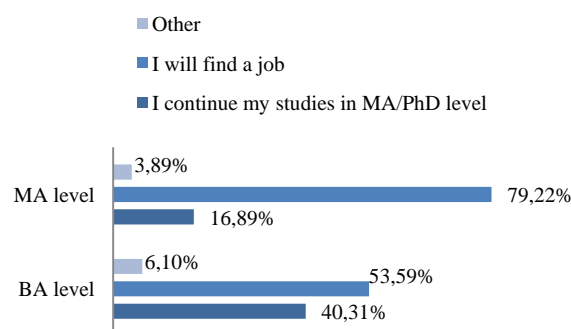


Figure 1: Students plan after their studies at BA and MA level

2. Methodology of the research

This research points out how specific examples from the practice can be incorporated into individual lessons at the university, thus ensuring that students come across examples that appear in the real labor market during their studies. This is essential because we can see at the Figure 1, that students want to find a job after finishing their studies.

I collected materials (announcements, notifications, information published on the social network, situations etc.) during the field research. All of the texts which the students of the test group practiced are appearing in the labor market. Usually the written texts are Hungarian-Slovak bilingual, what is really important, because by these texts' students are able to practice both languages. After practicing the texts, the test group (consist of 5 first-year students on the study program Hungarian-Slovak Bilingual Mediator) filled a questionnaire in which they could express their views about the new method of learning. Questionnaire responses indicate whether or not students find it more useful and practice-oriented to

educate with the new methods. These texts were practiced on the course *Orthography of Hungarian Language* and *Theory of Administration and Business Communication*

3. Collected materials at field research

In the last couple of months, I was visiting different municipal offices where I made an interview with the mayors (these interviews are for my doctoral dissertation). During these field researches I collected different texts and situations from the labor market to use them into education. These texts are mainly announcements, notifications to the citizens and information published to the social media (Facebook). The situations are between the administrator – client; administrator – administrator; administrator – manager; etc.

The collected texts are usually (Hungarian-Slovak) bilingual because I visited municipalities where the Hungarian minority language can be used during the administration. The following examples are two of the collected texts in Hungarian (H) and Slovak (S) language what I translate to English (E) for clarity. Translating this text into English is difficult due to administrative terminology.

H1: *A járat megszüntetésének egyik oka az, hogy az átengedett központi adókból származó bevétel egy részének kiesése miatt várhatóan csökken a város költségvetése, esetében ez ebben az évben mintegy 1,6 millió eurót tesz ki.*

S1: *Jedným z dôvodov vyradenia linky je očakávané zníženie rozpočtu mesta v dôsledku výpadku časti príjmov z podielových daní, čo v prípade predstavuje okolo 1,6 mil. eur na tento rok.*

E1: *One of the reasons for the cancellation of the bus line is the partial loss of the revenue from the transferred central taxes, which is also expected to reduce the city's budget, which in will be around € 1.6 million this year.*

H2: *A Nyugat-szlovákiai Vízművek Rt. értesítik a lakosságot, hogy 2021. szeptember 6-tól, holnaptól megkezdik a tervezett féléves elszámoláshoz a vízórák leolvasását.*

S2: *Západoslovenská vodárenská spoločnosť oznamuje občanom, že od 6. septembra 2021 od zajtra začínajú riadny odpočet stavu vodomeroov.*

E2: *Western-Slovakian Waterworks informs citizens that from tomorrow, 6 September 2021 the deduction of water meter will start for the planned half-yearly settlement.*

The collected texts can be presented to the students, and are great practice material.

4. Practicing collected texts on the lesson "Orthography of Hungarian Language"

The orthography can be practiced by dictation of these texts. The theoretical part of the given topic was practiced by the students with texts in which the topic appeared. Practicing capitalization, orthography of institutions name

or spelling of geographical names (for example National Council of the Slovak Republic, Trnava country, Ministry of Education, Science and Research of the Slovak Republic etc.) by these texts are easier and more meaningful, because at the labor market the students need to know how to spell and write these things correctly.

That part of the questionnaire which focused to this lesson contained 3 questions (Q):

Q1: *Do you think that it would contribute to practice-oriented training if we worked with texts that appear in real office administration?*

Q2: *Do you think that teaching with new methods would prove more useful than the current method?*

Q3: *Do you think that the following topics could be improved by these kinds of texts? (the topics are: spelling the date and numbers; spelling of geographical names; spelling of institution names; spelling of abbreviations; spelling subordinate word combinations; alphabet classification)*

All of the students agreed that practicing these kinds of texts are really helpful, and more useful than then the current method (practicing spelling rules by random texts or practice sheets):

A1: *„Yes, it would help to make the course more practical, because if we see these types of documents, it is much easier to memorize the theoretical part.”*

A1: *“It would definitely contribute! I think it is very important that we work with real documents and office problems. This is important because we may find ourselves in these situations later on.”*

A2: *„In my opinion, both methods of teaching prove to be useful, but teaching with the new method would be more efficient, because we practiced not only the spelling, but we could also learn how these kinds of texts look like.”*

To the 3rd question the students gave the following answer:

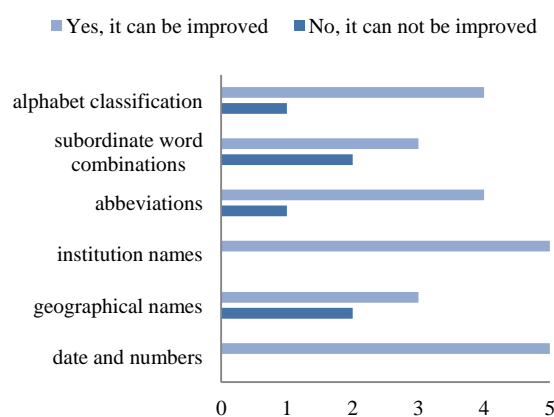


Figure 2: Improving specific topics according to the students

As we can see the practice-oriented education can be improved by practicing texts from the real labor market. By these texts' students can get acquainted with the language and structure of official administrative texts,

letters, etc. With this kind of knowledge, the graduate students became more confident and more prepared for the labor market.

5. Practicing collected situations on the lesson “Theory of Administration and Business Communication”

The information gained from field research could help to force the student to situations that are common at the administrative job market. Most of these situations were monolingual, Hungarian dialogue where the client goes into the municipal office to handle a case or situations between employees and situations between the manager and the employees. By these situations students easily can practice the different types of communication, such as assertive communication and examine the non-verbal communication as well. In these kinds of situations, the administrative terminology also appears, so the student can practice. The collected texts shown above also can be used on this lesson, one of the questions in the questionnaire was referring to these texts.

This part of the questionnaire also contained 3 questions (Q):

Q1: *Do you think, that situation games would improve practice-oriented training?*

Q2: *Do you think it would be necessary to write and practice more letters and texts that appear in official life to facilitate practice-oriented training?*

Q3: *Do you think that teaching with these new methods would be more useful than the current method of teaching?*

According to the students, learning through these kinds of situations could make the learning fun and enjoyable. They enjoyed the role-playing, and think, that these are things, what arouses students' interest and makes it easier and more playful to understand the theory through practice. The following replies were received to the questionnaire:

A1: *“Definitely improve it, because it is a funny and enjoyable way to learn. It arouses students' interest and makes it easier and more playful to understand the theory through practice.”*

A2: *„It would help if we could see what is the correct way to write an official letter. „Yes, I think there could be more exercises for writing letters in different situations, because I think we can memorize the most by the exercises.”*

A2: *„Writing texts and letters is extremely important, because we have to learn the style and spelling of the official letters.”*

A3: *„Yes, I am pretty sure! Although theory is a very important part of the learning, I learned the most during the exercises.”*

We can see, that according to the students, they really enjoyed the training by these situational games, and they feel that they learned the most during these kinds of games. These games improve students' communication skills, what is really important, because most of the research proves ^[5,6,7] that the existence of communicative competence is essential for an administrative officer, as communication with people is inevitable in this career, and

they can be more confident by practicing these situations at the university.

The Figure 3 shows, that according to the students more emphasis should be place to verbal communication. Only 1 from 5 student thinks that practicing written communication by the collected texts is more important, than practicing verbal communication through role-playing games.

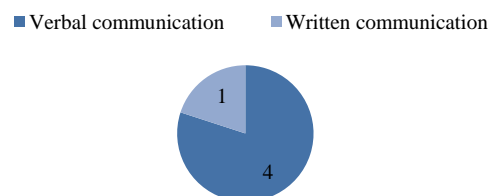


Figure 3: Students opinion about improving verbal and written communication

That one student thinks, that „practicing written communication is very necessary, as we need to be perfect in writing such letters, as our profession requires it”.

6. Conclusions

The collected texts and situations mentioned in this study illustrate how it is possible to reconcile education with the labor market practices. The advantages of this kind of education is also seen by the students. According to them, practicing these kinds of texts and role-playing situations from real life labor experiences not only allows them to understand and deepen their curriculum in a given lesson, but also contributes to their whole study. They gain huge advantages by practicing texts and situational games: no matter what course students are working on with these materials, they constantly work texts and situations that appear in their profession on a daily basis. This is essential, because the ration of youth unemployment is higher than the adult unemployment, and the main reason is the preference of experienced adult workers with adequate skills ^[8]. By practicing real labor market situations, graduated students can be more prepared for the difficulties of the labor market and thus became a better choice for employers as well.

Students think as well, that education through texts from real administration is more useful then the practicing random texts.

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Session: History, Sociology

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ISSUES OF PSYCHOTHERAPY PERFORMED BY SOCIAL WORKERS IN THE CONDITIONS OF THE SLOVAK REPUBLIC

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Abstract: The paper focuses on psychotherapy in social work, describes the conditions for the implementation of psychotherapy by social workers and points to the lack of psychotherapists in Slovakia. Another part of the paper deals with the limitation of psychotherapy in Slovakia by legislation and research. The research shows that psychotherapy in Slovakia is undersized on several levels. Statistics show that only 14 social workers are registered with the Slovak Institute for Education in Psychotherapy.

Keywords: psychotherapy, psychotherapist, social worker, psychotherapy legislation

1. Introduction

Social work in the conditions of the Slovak Republic has a wide field of competence, the aim of which is to detect, explain, mitigate, and solve social problems. The author Matoušek [1] defines social work as follows: "it is a professional activity with the aim of helping individuals, groups or communities, improve or restore the ability of social functions and create social conditions favorable for this goal."

- in healthcare,
- social services,
- education,
- in public administration,
- and other. [2]

It follows from the wide scope that social work cooperates with various scientific disciplines. The intersection between psychotherapy and social work is the use of many approaches. Some elements or methods are used both in social counseling and in psychotherapy. The author Novotná [4] also adds that these two professions often overlap. On the contrary, according to some authors [3], among the basic differences between social work, ie social counseling and psychotherapy, are the specificity of the problem, the type of client, the intervention provided and the requirements for the performance of the profession.

Table 1 Differences in social work and psychotherapy

Social work	
Specificity of the problem	Solution of socio-economic-psychological problem.
The client	Mostly an individual or social group usually with low socioeconomic status, at risk, or excluded; an individual who has frustrated bio-psycho-social needs.
Intervention	Professional intervention in the form of a counseling interview in the field of law, medicine, financial security, etc., or specific practical social assistance in "material or social need".
Professional	Education: at least assistant social worker -

requirements.	Bachelor of Social Work Skills: socio-psychological training.
Psychotherapy	
Specificity of the problem	Solution of psychological and psychosomatic problems, personal growth of the client.
The client	An individual, couple, or family where the cause of a disrupted interpersonal relationship is an intrapersonal conflict or problem.
Intervention	individual, couple or family psychotherapy or psychological counseling according to different directions and approaches.
Professional requirements	Education: At least at the second level in the field of a doctor, psychologist, social worker, etc. Skills: training in psychotherapy in the appropriate direction.

2. Differences in psychotherapy between Slovakia and other European countries

Mental problems accompany people all over the world. Some of them may restrict a person significantly, both mentally and physically. One of the effective tools for solving these problems is a combination of drug treatment together with psychotherapeutic sessions. [5] Psychotherapy in the conditions of the Slovak Republic is not defined as a scientific discipline, it cannot be studied as an independent scientific field and is closely connected (especially by law) with health care. Psychotherapy is defined as: "intentional and planned modification of disrupted activities of the organism by psychological means". [4] It is not only focused on treatment (secondary prevention) but also prophylaxis (primary prevention) or rehabilitation (tertiary prevention). [6] According to the Act of the National Council of the Slovak Republic 957/2002 about the performance of psychotherapeutic activities [7], it is possible to perform psychotherapy as follows:

"Psychotherapeutic activity under this Act may be performed independently, on his behalf, on his responsibility and for remuneration only by a natural person or employee in a non-state institution who is entered in the list of psychotherapists (hereinafter" list ")

maintained by the Chamber." There are several enrollments in the list of psychotherapists, which are divided into four main points:

- A health professionals,
- B non-health workers,
- C non-medical staff not classified in the second group,
- D inclusion in the further psychotherapeutic education [8].

If a social worker wants to perform psychotherapy, he can do so after fulfilling the conditions of the SIVP (Slovak Institute for Education in Psychotherapy) under category B without the possibility of reimbursement from health insurance. Another possibility is the performance of professional activities, social counselling with elements used in psychotherapy or therapy with elements of psychotherapy, etc. Whether within the independent praxis of a social worker or an institution. As psychotherapy in Slovakia is considered a health profession, according to the Act 576/2004 [9] and the SIVP document [8], it can be performed only by:

- doctor,
- nurse,
- psychologist,
- speech therapist, or
- medical pedagogue.

However, according to Act 296/2010 [10], a government regulation establishes professional competence to perform professional work activities (psychotherapy e.27, b.3) belonging only to doctors and psychologists. In addition to the standards completed in the field of psychotherapy and other conditions, it is, therefore, possible for physicians and psychologists to pay for psychotherapy from health insurance. The problem arises in the boundaries between counselling and psychotherapy, where some therapists defend themselves by saying, "What is not forbidden is allowed."

The minimum standards for certified psychotherapy work consist of several parts. A participant in psychotherapeutic training who wants to perform a certified work activity (psychotherapy), whether in categories A, B or D according to the SIVP criteria, requires laws and the Journal of the Ministry of Health of the Slovak Republic [11] to complete.

Theoretical studies:

- Extent of theoretical knowledge in the number of 150 hours, of which 50 hours are provided by SIVP.
- Practical experience:
- Psychotherapeutic methods, self-experience for at least 350 hours.
- Individual psychotherapy 150 hours.
- Supervision 200 hours.

- 3 years long experience in a facility where psychotherapy is provided, of which at least 200 hours in a psychiatric facility.
- Psychotherapeutic praxis under the supervision of a certified psychotherapist 600 hours.

The approaches of psychotherapists with several variations in the EU are dominated by 3 of them: Insight-oriented, cognitive-behavioral, and humanistic. An eclectic approach is also used. Within Europe, the standards for the performance of psychotherapy in Slovakia are relatively similar in comparison with other countries. The conditions for successful completion of training are similarly around 4-5 years. The conditions of the European Association for Psychotherapy EAP have even lower criteria than in Slovakia. The difference is in the "experience of yourself" 250 hours and supervision 50 hours. A significant difference is the definition of psychotherapy as an independent scientific field in addition to psychology and psychiatry and the anchoring of psychotherapy in law. In countries such as Austria, Poland, the Czech Republic, Germany, or Switzerland, it is also permitted to provide psychotherapy to other humanitarian workers, where psychotherapy is clearly defined and has set conditions and criteria for its performance. In addition, in most countries, it is covered by health insurance.

Based on statistical data and research, psychotherapy in Slovakia is negatively affected by two factors. The first factor, according to the European Association for Psychotherapy [12], is the low number of psychotherapists who provide psychotherapy. Slovakia is one of the countries with the smallest number of psychotherapists in terms of population. Specifically, there are 8 psychotherapists per 100,000 inhabitants. Compared to other countries, for example, Austria has 86 therapists, Switzerland has 66 therapists or Hungary has 28 therapists. As far as psychotherapists - social workers, there are only 14 members registered in the SIVP institute in Slovakia [13]. Compared to the implementation of social counselling according to the author Fričová [14], there are no more social counsellors in Slovakia. The second negative factor is the affordability of psychotherapy. The first statistics [15] show that after Romania, Slovakia is the second country with the highest number of hours worked within the minimum wage needed for repayment of the psychotherapeutic sessions. The second statistic [16] points to the negative factor of respondents "price of psychotherapy" as the biggest obstacle in deciding to enter psychotherapy. There are several accredited institutes in Slovakia that offer full-fledged education and training. It is also possible to complete training abroad with subsequent recognition of training in Slovakia. An important part of the visibility of psychotherapy is its enlightenment. This activity is not initiated either by the ministries or by the institutions dealing with psychotherapy themselves. So the promotion of help remains solely with the psychotherapists themselves.

3. Conclusion

The article referring to the legislation and statistical data shows that psychotherapy in Slovakia is very undersized (legislatively and personally). The article wants to point out that a social worker can also become a certified psychotherapist. However, as can be seen, the 14 registered members are very few. Furthermore, legislative restrictions may cause that under the guise of the word therapy, it will be performed by some pseudo therapists unprofessionally and that people who seek help will not receive it. Although psychotherapy is not taught in Slovak schools at this time, it is needed to approach this profession at universities, and it is necessary to talk about it to the public. A person's mental health is important.

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ANALYSIS OF CORPORATE SOCIAL RESPONSIBILITY ON THE SOCIAL PILLAR

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Abstract: *In recent years, the idea of corporate social responsibility has become increasingly in the interests of companies in the world and in Slovakia. However, we are constantly confronted with differences in our understanding of responsible business, which is often narrowed down to philanthropic activities. However, responsible business involves access to all stakeholders of the company and also examines the environmental, economic and social level. Companies solve questions whether to do business with a focus on a wider circle of people, or to look only for the benefit of the company. Many studies suggest that focusing on profit-only activities is no longer sufficient. The article analyzes the concept of corporate social responsibility with regard to the social pillar containing the internal and external dimension of the company. There are also briefly discussed the standards of corporate social responsibility. Based on various researches, it can be said that corporate social responsibility brings many benefits. Despite various discussions about the appropriateness of applying corporate social responsibility, it is more than certain that social responsibility is becoming a necessity for companies, because the success of any company is based on the right approach to people. For the corporate social responsibility, the key to success is to maintain and develop relationships with the people whose activities influence the company.*

Keywords: *corporate social responsibility, social pillar, standards*

1. Introduction

While it is very important for a company to make a profit in its results, it is equally important for it to operate in an ethical and sustainable way because of the younger generations and the negative effects on the environment. Nowadays, many companies are asking whether corporate social responsibility is really important for companies. Although the application of corporate social responsibility is not required by law, it is ethically important for all companies. The results of the statistics show that people prefer companies with social responsibility [12].

2. Corporate social responsibility

The Ministry of Labor, Social Affairs and Family of the Slovak Republic defines corporate social responsibility as: *"voluntary efforts of companies that go beyond the normal framework of compliance with legal regulations. It is an increasing involvement of all key partners in the daily activities of companies and institutions"* [6].

Corporate social responsibility is a self-regulated business model, helping society to be socially responsible to the public, itself and its stakeholders. By applying corporate social responsibility, companies have an impact on all aspects of society, namely economic, social and environmental. By practicing corporate social responsibility, businesses improve the environment and society without making a negative contribution. Corporate social responsibility creates strong relationships between companies and employees, raises morale and also has greater links between employers, employees and the world around them. Larger corporations are taking the biggest initiative in creating social responsibility programs, but we are also increasingly encountering small and medium-sized enterprises. Starbucks and Ben and Jerry's are typical

examples of a company striving to become a leader in corporate social responsibility [4].

In its corporate social responsibility report, Aflac reports that investors, consumers and employees are putting increasing pressure on US corporations to contribute to the social good. According to this report, up to 77% of consumers are willing to buy products from companies if they address environmental, social and economic reforms. About half of the respondents said that companies need to make the world a better place. On the contrary, 37% claimed that companies have to make money for shareholders. According to a Deloitte survey in 2019, environmental protection and climate change is one of the main challenges [5].

Many companies said they would be socially responsible, so in November 2019, a report was published by Newsweek entitled America's Most Responsible Companies 2020, where more than 2,000 companies participated in the research, which included about 6,500 surveys. The result was the top 10 most responsible companies, namely HP, Cisco, Dell, Intel, Microsoft, NVIDIA, Citigroup, General Mills, Comerica and Jones Lang La Salle [8].

Also in 2019, the Reputation Institute conducted a similar survey and the result was the most responsible companies in the world in the field of corporate social responsibility. It was a survey with 230 000 participants in 15 countries. The aim was to find out which companies in the field of corporate social responsibility have the best reputation. The top 10 companies include Lego, Natura, Microsoft, Google, Disney, Bosch, Havaianas, Intel, Lavazza and Ikea [5].

In 2010, the International Organization for Standardization ISO 26 000 issued voluntary standards to help implement corporate social responsibility. In these standards, it explains the concept of social responsibility and helps to implement the principles of corporate social responsibility in practice [4].

There are several non-governmental organizations in Slovakia, such as the Pontis Foundation, the Integra Foundation, the Institute for Economic and Social Forms (INEKO), the Center for Philanthropy, o. z., PANET, which seek to create awareness of corporate social responsibility.. The Pontis Foundation is one of the largest grant foundations in Slovakia with the aim of motivating individuals and companies, evaluating companies from various perspectives, including in terms of responsible business. Firms that are judged exceptional in supporting society, improving environmental and corporate relations will receive the Via Bona award [2].

Table 1 Winners of Via Bono Slovakia for individual years

Year	Small, medium and large companies	Vinner
2020	50	Tesco Stores SR
2019	38	ESET
2018	56	Accenture
2017	48	Slovenská sporiteľňa
2016	71	Kia Motors Slovakia s.r.o.
2015	18	Heineken Slovensko

Source: own processing according to [7].

The winners of Via Bono Slovakia 2020 focused on mental health care, helping gastronomy overcome the first wave of the pandemic corona and also integrating disadvantaged people into working life. In Slovakia, 50 small, medium and large companies applied for this award in 2020 with 70 examples of responsible business that apply responsible business. Of the seven categories, the winner in the main category Responsible large company became Tesco Stores SR, which is also a leader in the fight against food waste [7].

Corporate social responsibility is a broad concept, so companies implement social responsibility differently, but corporate social responsibility has three interrelated pillars, namely the economic, environmental and social pillars, which can be seen in the following figure.



Figure 1 Pillars of corporate social responsibility

Source: own processing.

The main goal of environmental responsibility is to eliminate pollution and greenhouse gas emissions and the sustainability of the use of natural resources. Responsibility for human rights applies fair working practices and business practices. In the case of philanthropic responsibility, it is about funding educational programs, supporting community projects, supporting health-related initiatives, etc. Improving business performance concerns economic responsibility initiatives [13].

Corporate social responsibility is a voluntary involvement of companies and therefore no definitions can replace the internal belief in the positive impact of developing corporate social responsibility on the market [10].

2.1 Benefits of corporate social responsibility

If, in addition to the primary goal of making a profit, companies want to focus on the overall functioning of the company and also on the environment, then not only the company but the whole society will benefit. Thanks to this orientation, companies will increase the reputation, productivity of employees and in the end the primary goal will be achieved - profit.

There are several benefits of corporate social responsibility, such as risk management, increasing profits, as according to several researches, consumers prefer to buy from responsible companies. Corporate social responsibility looks at companies as its members of the company consisting of stakeholders, on the basis of which the company should openly discuss and thus convince the correctness of the company's conduct. Corporate social responsibility creates a good reputation in building a brand and trust, the company is also more attractive to investors, as corporate social responsibility means security and safety of the company. Employees are more motivated to work in the company, the favor of residents and local government is increasing [3].

3. Social pillar of corporate social responsibility

The social pillar of corporate social responsibility aims to create employee satisfaction, and this leads to increasing the company's profits. In the social field, corporate social responsibility can be divided into two groups - internal and external group.

3.1 Internal and external dimension of the social pillar of corporate social responsibility

In the internal area, corporate social responsibility examines the care of employees, while in the external area, attention is paid to interest groups. Satisfied and loyal employees are the basis of every company, because the company is the place where they spend most of their time, which affects their health and private life.

Table 2 Tools of internal and external dimension of the social pillar of corporate social responsibility

Internal area	External area
Employee involvement and communication	Community development
Education and their development	Stakeholder involvement
Financial and non - financial valuation	Cooperation with schools
Health and safety	
Equal opportunities	
Outplacement	
Recruitment of employees	

Source: own processing according to [1].

Recruitment is one of the important aspects of corporate social responsibility, so there should be no discrimination based on religion, age or gender. In 2016, the Government of the Slovak Republic approved the Basis for the Implementation of the 2030 Agenda for Sustainable Development. One of the aims is to eliminate discrimination and equal pay for men and women. Based on data from the Statistical Office of the Slovak Republic, the following figure shows the gender wage gap from the average gross monthly wage in selected countries of the European Union and in the Slovak Republic from 2000 to 2015 [11].

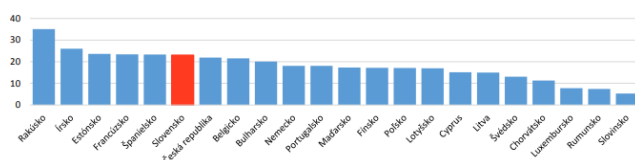


Figure 2 Gender wage difference from the average gross monthly wage in the countries of the European Union in 2015 (in %)

Source: [11].

In the European Union, the highest gender pay gap was recorded in Austria, at 35.1%.

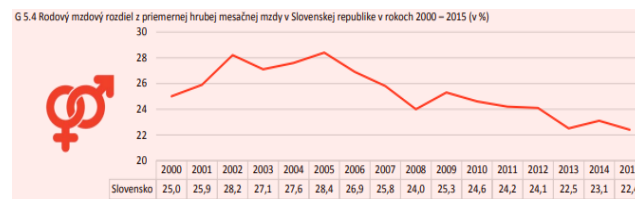


Figure 3 Gender wage difference from the average gross monthly wage in the Slovak Republic in the years 2000 - 2015 (in %)

Source: [11].

Although the level of education is higher for women than for men, they do not achieve comparable earnings with men. The wage gap between men and women peaked at 29.9 % between the ages of 40 and 44, with the ages of 45 to 49 at 27.2% and 10.5 % between the ages of 25 and 29 [11].

Corporate social responsibility cannot include instruments and elements that are not in line with international agreements and legal requirements [1].

3.2 Standards

The standards applied in the social field can be seen in the following table.

Table 3 Social standards

Standards		The aim of the standards
OHSAS 18001	Occupational health and safety management system	It sets out principles for reducing accidents at work and accidents
SA 8000	Social Accountability	It assesses the organization's ability to meet the requirements of the work environment
ISO 26000	Corporate social responsibility	It monitors the overall strategy of the company
AA 1000	Assurance standard	It contains 3 standards, instructions for improving the company's strategy

Source: own processing.

The SA8000, the world's leading social certification program, is a globally recognized standard for corporate social responsibility a focus on the social pillar. This program offers all organizations in different industries and in different countries a fair and decent way of doing business with the highest social standards. In 1997, Social Accountability International (SAI) created the first social certification that has led the industry for more than 20 years. The SA8000 standard consists of internationally recognized human labor standards, the Universal Declaration of Human Rights, national laws, and ILO conventions. The basic elements of this standard include child labor, forced labor, discrimination, working time, remuneration, health and safety, freedom of association and management [9].

4. Conclusions

Nowadays, more and more companies, investors and consumers are emphasizing the importance of corporate social responsibility, and therefore it will be important for other companies to follow them. Research shows that corporate social responsibility has a positive effect on companies' results. Employees and customers alike are happy to support companies that look to the needs of society and the socially responsible. corporate social responsibility helps to make the world a better place and also helps businesses to prosper.

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CURRENT STATE OF SOCIAL ENTERPRISE IN SLOVAKIA

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Abstract: The role of social enterprises is crucial in addressing the various societal challenges, as it mainly concerns job creation, including disadvantaged people. The aim of the article is a theoretical analysis of the current state of social enterprises occurring in Slovakia, to point out the new understanding of social enterprises and to analyze the effects that social entrepreneurship brings.

Keywords: social entrepreneurship, social enterprise, unemployment

1. Introduction

In connection with the problems of social systems and globalization, the social economy and social entrepreneurship are also of greater importance in Slovakia. We are facing the problems of long-term unemployment, people who are at risk of social exclusion, and globalization is also bringing increasing effects in our country. As a result of these problems in the social economy, various solutions to such problems are emerging. A significant event in Slovakia in the social economy was the adoption of an active labor market policy instrument, namely the legitimacy of social entrepreneurship with effect from 1 September 2008, when the first legislative framework for social enterprises for work integration was created [5].

2. Social entrepreneurship

Social entrepreneurship is about achieving social change and differentiating social problems through business operations and processes. Social entrepreneurship is also aimed at creating social capital, but without evaluating profit performance. Of course, the need to make a profit is not out of the question, as all companies need capital for positive changes in society. There are well-known social entrepreneurs in the world who have helped society. The founder of Grameen Bank, Muhammad Yunus, has won the Nobel Peace Prize, the non-profit social enterprise Rang De, the social enterprise George Foundation and many other companies that address social problems and influence society through positive change [3].

Social entrepreneurship is targeted at certain groups of people. These are disadvantaged groups, marginalized groups, vulnerable groups, people with environmental protection and people at a disadvantage in the labor market, such as people older than 50 years, people registered at the employment office for more than 1 year, dependents, third country nationals, disabled people, etc. [1].

3. Social enterprises

According to Act 112/2018 Coll. on the social economy and social enterprises A social enterprise is "a social

economy entity whose main objective is to achieve a measurable positive social impact which, if it profits from its activities, will use more than 50 % of its profit after tax to achieve its main objective" [8].

The following table shows the current number of registered social enterprises as of 11. October 2021 and the registered unemployment rate at the end of August 2021, divided into the available and unavailable number of job seekers in the individual regions of the Slovak Republic.

Table 1 Indicators in the field of social entrepreneurship and unemployment

Region	Social enterprises	Unemployment in %	Unavailable candidates	Available candidates
Bratislava	26	5,05	561	17 924
Trnava	29	4,83	1 074	13 841
Trenčín	66	4,91	2 244	14 550
Nitra	28	5,25	2 060	17 737
Žilina	77	5,88	1 829	20 254
Banská Bystrica	69	9,52	3 174	30 660
Prešov	57	11,31	3 813	44 145
Košice	84	10,82	3 864	40 417

Source: own processing according to [7].

As for the number of social enterprises, the Košice and Žilina regions lead. On the contrary, the smallest number of social enterprises is in the Bratislava and Trnava regions. For comparison, the registered unemployment rate is the highest in the east of the country in the Prešov and Košice regions, also in central Slovakia and the lowest in the west of the country in the Trnava and Trenčín regions. Eastern and Central Slovakia have difficult conditions for creating new job opportunities and there is also a group of people with long-term unemployment who have lost or have no work habits at all. One of the solutions to this problem with the uneven unemployment rate in the regions is social entrepreneurship.

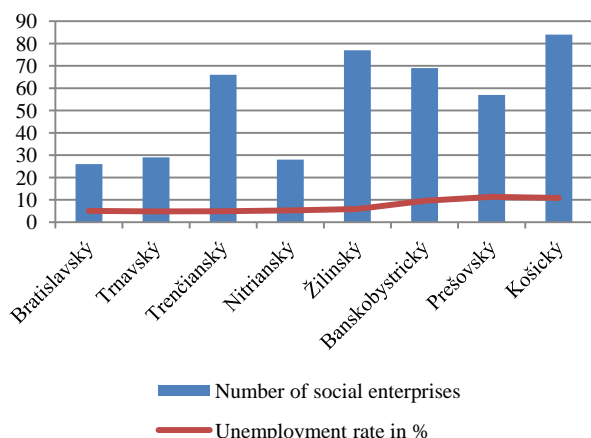


Figure 1 Comparison of social enterprises and the unemployed

Source: own processing.

When comparing the two graphs, it can be said that if there is a larger number of social enterprises in a given region, then the registered unemployment rate is higher. For this reason, it is necessary to focus on social entrepreneurship and the development of social enterprises in regions with a larger number of registered unemployed persons.

The following table shows the current status of disadvantaged job seekers at the end of August 2021. In the east of the country, the Prešov and Košice regions have the largest number of disadvantaged job seekers. Subsequently, it leads the Banská Bystrica Region and the Žilina Region.

Table 2 Disadvantaged jobseekers at the end of August 2021

Region	Disadvantaged job seekers
Bratislava	13 568
Trnava	11 471
Trenčín	12 368
Nitra	15 809
Žilina	17 951
Banská Bystrica	29 888
Prešov	42 890
Košice	39 491
Together	183 436

Source: own processing according to [7].

Among disadvantaged job seekers according to § 8 par. 1 Act. no. 5/2004 Coll. includes a citizen under the age of 26, a citizen over the age of 50, a long - term unemployed citizen, a citizen with lower education than secondary, a unemployed citizen for 1 year, a third - country national, a single citizen and a severely disabled citizen [9].

3.1 Municipal social enterprises

State cooperation is also important in the creation of social enterprises. In recent years, there has been a growing interest in setting up municipal social enterprises, for

which it is necessary to choose the legal form. Legal forms for municipal social enterprises are civic associations, non-profit organizations, a trade license for a municipality, a limited liability company, interest associations of legal entities and a separate contributory organization or budgetary organization [2].

According to Act 112/2018 Coll. on the social economy and social enterprises we distinguish three types of registered social enterprises, namely an integrated public benefit enterprise with the aim of supporting the employment of disadvantaged and vulnerable persons, a social housing enterprise with the aim of providing socially beneficial rental housing and a general registered social enterprise with the aim of providing socially beneficial services according to law on the social economy and social enterprises [6].

As of October 11, 2021, there are 422 registered social enterprises in 437 establishments in Slovakia. The following table shows registered social enterprises in Slovakia divided by regions and type of classification [4].

Table 3 Registered social enterprises in Slovakia as of 11.10.2021

Region	A	B	C	D
Bratislava	25	0	1	0
Trnava	18	0	9	2
Trenčín	64	0	2	0
Nitra	27	0	1	0
Žilina	74	0	3	0
Banská Bystrica	62	0	6	1
Prešov	56	1	0	0
Košice	78	0	6	0

A - Integration enterprise,
 B - Integration enterprise/housing social enterprise,
 C - Integration enterprise / General registered social enterprise,
 D - General registered social enterprise.

Source: own processing according to [4].

4. Conclusions

Social enterprises should maintain cooperation with the public sector, due to the employment of disadvantaged citizens, the social needs of localities, etc., which could contribute to reducing unemployment, to problem groups of citizens who are unable to find employment as a result of losing work habits and skills. Social enterprises need to be supported and protected from external influences by appropriate policies, to support the creation of new social enterprises and to help overcome barriers in existing social enterprises. Social enterprises are dependent on the external economic environment, which is associated with the economic health of the region.

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