CER Comparative European Research 2018

Proceedings | Research Track

of the 9th Biannual
CER Comparative European Research
Conference

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

March 28-30, 2018 | London

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Published in March, 2018 by Sciemcee Publishing, London.

Proceedings document published in collaboration with SCIEMCEE - Scientific Conference Platform.
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ISBN 978-0-9935191-7-8

SCIEMCEE
PUBLISHING LONDON

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 2018 (March 28-30).

The biannual international scientific conference is organized under the auspices of the SCIEMCEE 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 2018 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 2018 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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STUDY THE RELATIONSHIP OF THE NET PROMOTER SCORE (NPS) THROUGH CASE STUDIES TO HELP ORGANIZATIONS IMPROVE THEIR CUSTOMER SERVICE EXPERIENCES

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Abstract: *Most people realize that customer service is the most important metrics to use for measuring long-term success of an organization in order to retain good customers and grow profit for organizations. Good customer service is all about trying to meet the customer needs, demands, and expectations and provide solutions to any problems that customers might experience. Customer success managment companies train their employees to understand how to avoid bad customer services and keep customer happy because they will lose their customers and they realize that customers will never come back and buy their products or services from their business again. On the other hand, if the company willing to put an extra effort to help their business grow by providing excellence customer services, eventually, great customer services will lead to customer satisfaction which keep the customer happy and come back to buy for more products and services. One of the customer satisfaction metrics that is used to measure customer satisfaction is the Net Prototer Score (NPS). Net Promoter Score (NPS) is a great tool that every organization must have in order to assist the mangers in tracking their business operations as related to measure customer satisfaction that impacts on business support and operation. This paper presents detailed information of the study the relationship effects of the Net Promoter Score through case studies and to interpret a NPS analysis to help organizations improve customer services.*

Keywords: *score, product, services, customers, satisfaction*

1. Introduction

To cope with the rise in demand against your competitors in the same market place. Companies must have do so much more than what they have done in order to stay competitive in the market place. They have to create new market strategy, improve performance plan, and maintain good customer services. Maintain good customer services in the workplace is extremely important because if the customers are happy with their services they tend to come back to buy more products. Companies also think about the new way of building the new customer relationship internally and externally and avoided losing customers because replacing a customer is very costly to the orgazation. Organization would have spend more time to train customer to get ground running so they can perform their duties. In addition, they would also have to spend more time and money to develop the performance plan to make sure their employees perform as they expected. They woud have to send them to colleges and school to obtain a degree when the jobs are required more skills. According to the Real Cost of Losing Customers article [1], Jones has cited that it can cost organization five times more to attract new customers than retain existing ones. In addtion, Jones found that "13% of disatisfied customer tell up to 20 other people while a satisfied customer tells only five other people" (para.02).

In order to improve customer experience and customer related matters in the organization. Companies must need to know where they stand with customer services. Net promoter score (NPS) has been around it is designed specifically to assess and measure customer satisfactions after recent interaction with your product or services. NPS is very important metric to help company measure customer satisfaction. NPS is used a simple method to determine the score ranges from 0-10 and it is calcualted based on a sample of customer responses based on a question how likely would you recommend this product or services to friends and family? . The higher the NPS score the better for the organization and the more products and services the companies will expect to sell. If your companies want to stay competitive with your competitor then your company score must be higher than your competitor. To keep the customer happy with their product and services, companies like to turn detractors and neutral into promoters over time then they will have to measure their customer experience over and over again in order to get the accurate results. Companies need to ask question to the users who have responsed with detractors and neutral why they feel disconnected about the product and services that the company are offered.

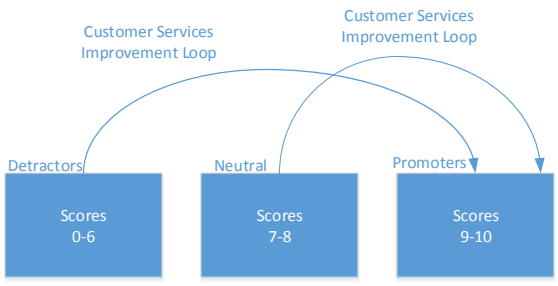

Figure 1: The Net Promoter Score (NPS) in the nutshell

2. Baseline Scenario

We started off with the baseline scenario in order to examine the current business situation about the Fish Net Type B product. The baseline scenario that we used in this study described as follow: the survey results from a sample of 100 users who are responsed to the question whether they would recommend a Fish Net Type B product to their friends and family. NPS is used a very simple method with a score range from 0-10 which 0 is a minimum score and 10 is a maximum score. We want to find out what is the NPS score of the Fish Net Type B business that sell the Fish Net Type B product.

To understand the baseline scenario, first we have to formulate the NPS into a set of equation below:

Let a = number of promoter responses

Let b = number of neutral responses

Let c = number of detractor responses

Let d = total number of responses from all promoters, neutral, and detractors

Net Promoter Score = (a – c) / d * 100 (Eq. 1)

To calculate the percentage of responses

Let x = % of promoter responses

Let y = % of neutral responses

Let z = % of detractor responses

Calculate the % of promoter responses = x / d (Eq. 2)

Calculate the % of neutral responses = y / d (Eq. 3)

Calculate the % of detractor responses = z / d (Eq. 4)

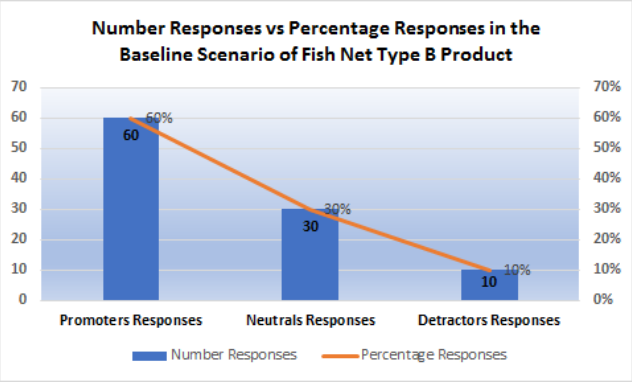

Figure 2: Baseline Scenario of the Fish Net Type B Product

Figure 2 represented the number of promoter responses in the Fish Net Type B product survey is 60, 30 is the number of neutral responses and, 10 is the number of the detractor responses. In subsequent, we also have 60 % of promoter responses, 30% is neutral responses and 10 % is detractor responses.

3. Results and Discussions of the NPS with Varying the Promoters and Neutral Scores as Compared to the Baseline Scenario

In the scenario 1 study, we try to vary the number of promoter responses and number of neutral responses and evaluate the impact to the overall NPS score. As compared to baseline scenario, we tried to decrease the number of promoter responses from 60 to 59 and increase the number of neutral responses from 30 to 31. With this change, we have our new NPS score of 49. In the study scenario 2, we basically trying to flip the number of responses from the promoters and neutral. Instead of decreasing the promoter score we are increasing it at this time, we changed from 60 to 61 by increasing 1 and we also reducing the neutral score from 30 to 29. We calculated the new NPS score is 51. Based on the NPS formula, we identified the percentage responses of promoters for Fish Net Type B product in study scenario 1 which in this case is 59 percent. The percentage of neutral responses is 31 percent and the percentage of detractor response is 10 percent. Apply the same formula in the study scenario 2, we get 61 percent of promoter response, 29% of neutral responses and 10 percent of detractor responses.

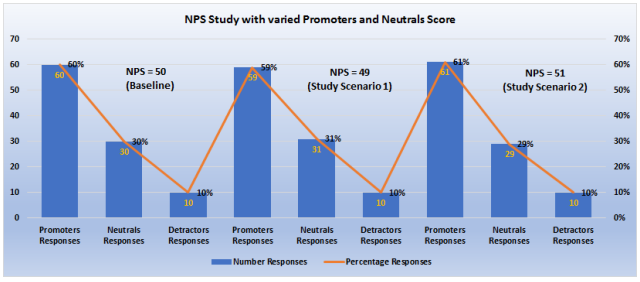

Figure 3: Study Scenario 1 and Study Scenario 2 vs. Baseline Scenario of the Fish Net Type B Product

4. Results and Discussions of the NPS with Varying the Promoters and Detractor Scores as Compared to the Baseline Scenario

In the study scenario 3, we tried to vary the number of promoters' response and the number of detractor responses then we evaluate the overall impact to the NPS score. As compared to the baseline scenario, in the study scenario 3 we tried to decrease the number of promoter response from 60 to 59, and increase the detractor response from 10 to 11. The new NPS score calculated for scenario 3 is 48. The percentage response of promoters is 59%, the percentage of neutral responses is 30% and finally the percentage of detractor response is 11%. On the other hand, in the scenario 4, we try to increase the number of promoter responses from 60 to 61 and we decrease the number of detractor response from 10 to 9. Our new calculated NPS score is 52. The percentage of promoter response is 61%,

the percentage of neutral responses is 30% and the percentage of detractor response is 11 percent.

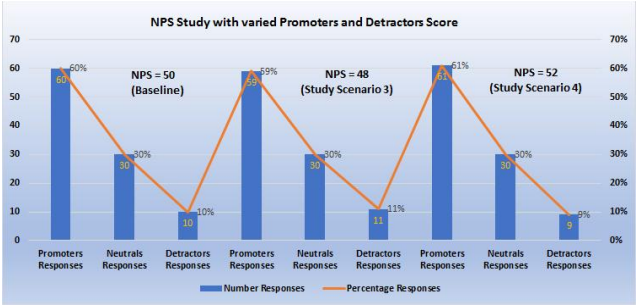

Figure 4: Study Scenario 3 and Study Scenario 4 vs. Baseline Scenario of the Fish Net Type B Product

5. Results and Discussions of the NPS with Varying the Neutral and Detractor Scores as Compared to the Baseline Scenario

To further study the impact to the NPS score, in study scenario 5, we try to vary the number of neutral and detractor responses and then evaluating the impact to the overall NPS score. We increase the number of neutral responses from 30 to 31 while we are decreasing the detractor responses from 10 to 9. The new calculated NPS score is 51. On the other hand, in study scenario 6, when we try to change the neutral response from 30 to 29 and increase the detractor response from 10 to 11. The new NPS score was calculated is 49. In study scenario 5, the percentage response of promoters is 60, 31 percentage of neutral responses and 9 percent of detractor responses. In study scenario 6, the percentage of responses is 60%, 29% is neutral responses, and 11 % percent of detractor responses.

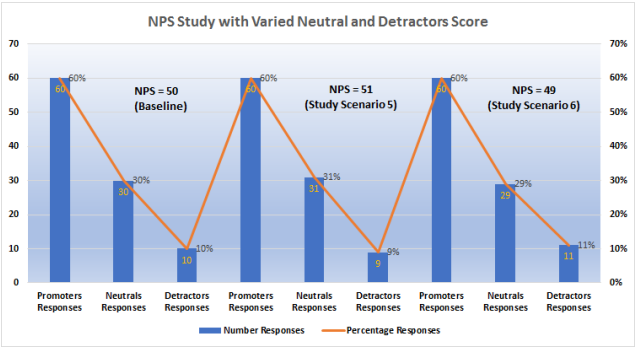

Figure 5: Study Scenario 5 and Study Scenario 6 vs. Baseline Scenario of the Fish Net Type B Product

6. General Practice of Conducting the NPS Analysis

In general, in order to stay competitive in the market place your company must have a higher NPS core than your competitor. Sometimes when conducting the NPS analysis, you want to see how company's NPS is different among different customer segments. How they are different from other categories and did you take into account the customer who live domestically in the same country or would you consider the responses from other country. Collecting the NPS data over time can provide great insight to important trend. One of the most important part is the feedback you get from customers will help your company make quick decision in implementing necessary change to keep your company profitable. Your company must be constantly evaluate the customer feedback to see if the changes you have recently made are resonating well with your customers. Your company can quickly grab the results, analyze them and understand how the customers interact with the products and services that your company has to offer. As a leader, you must take a proactive approach to talk directly with the customers, especially, when you have a situation of having a lower NPS score. As a leader in the organization, you need to find out the root cause as why and what made the customer feel dissatisfied about the products and services that your company offer. The leader should focuses on the negative responses especially the responses from customer who are the detractors which provided the score from 0-6. Leader shows that they care about customer by listening to their problem, then they should take time to come up with the approach to solve their problem. Then they need to repeat back the issues to show to customer that they care about their problem. If the company provides a good customer service, most likely excellent customer service will give you the opportunity to retain that customer.

7. Positive Metrics to Turn Detractors and Neutral Responses to Promoters

Customer experience is the experience that customers have about your products or services. However, each experience is different from one another depends on the environment that you work in, for instances, complaints at call center is different from complaints about lost of product. You need to understand the customer perspective in order to serve them well and that sharing experience and exchange between you and customers can help your business growth. In order for the business to be successful, we need to follow up with the detractors and apologize for the services and products that we provided to them. We need to do whatever possible to get these people back. We need to turn the detractor and neutral into the promoters. We need to build the loyalty by listening, acknowledge, and appreciate the customer feedback. Failing to acknowledge them could turn them into the detractors. When they feel appreciated you could ask them for more information about your product, for example, can you specially tell me what do you like particular about this product? If they are not happy about your product then offering an opportunity to fix it. In order to turn detractors and neutral into the promoters and achieve their customer loyalty, companies must train their employee to spend extra effort to help customer get their problem solved.

8. Conclusions

In this study, a detailed information is carried out to provide a brief outline of customer service and the NPS approach for improving the customer service and the customer behaviors that affects the business operations in

the organizations. An attempt was made to provide some NPS analysis so that organizational members would know how to interpret and analyze in different operating situations more effectively. The analysis also provided a deep understanding and the interpretation of the NPS analysis process and positive enforcement to achieve great customer services, as well as how the NPS affects the customer services based in their workplace operation. NPS gives us an idea to gauge where we stand on our performance over a period of time. The real focus is to promote the NPS to become higher by focusing on achieving excellent customer service. From the NPS perspective, we need to focus on score of 9 and 10, because customers are not only increase the frequency of purchase but they also refered it to other friends. Score 6 and below indicates the detractors, somebody who will not come back and buy your product and they also refer to other friends not to buy your products. Score 7 and 8 are neutral responses, they might or might not recommend the product or services to friends. 0-6 are indicators would not recommend product or services to friends, and high score of 9-10 means they definitely would recommend product or services to friends. As a leader in the organization, we need to repeat the NPS analysis over the time and take lead by implementing changes to improve the customer service in the organization. . Created loyal customer and exceeded the profit. When customer have great experience, they feel excited about it and they will tell friends about products and services. Satisfied customers tell their family and friends and other people that mean company will save money on marketing and advertising expense.

Acknowledgements

The author wishes to thank the academic officer and the counselor, Theresa, as well as the school staffs at LIGS University for inviting and providing guidance and opportunity for me to participate and present this paper at the Comparative European Research (CER) 2018 Conference. Thank you for your support, dedication, and hard work, as well as the extensive and insightful discussions with helping with throughout the registration information process, discount codes, and procedure to take part in the CER. Thank you for the opportunity to cooperate with my co-author on writing and reviewing this paper together. It's such a great cooperation opportunity to share wisdom, ideas, exchange on new concepts development to better research. Thank you the Comparative European Research's committee to provide an opportunity by hosting the online conference so that all the PhD students, faculty, researchers, and academia have a chance to participate and exchange new concepts and ideas about the work that we do.

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IMPACT OF SCIENCE AND TECHNOLOGY ON EFFECTIVE AND FUNCTIONAL HUMAN RESOURCE MANAGEMENT

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Abstract: *In recent years there has been a shift of emphasis from personal function to human resources management function. It gains ground after mid 70s and 80; and. in the mid 90. It is gaining strength after strength with the application of science and technology. The improved means of communication, technological advancement, computer and internet have brought the horizons closers and changed the functioning of the business world in a great way. Many business functions can be performed speedily and with much more accuracy with the aid of computers and the Internet. The impact of technology has been observed in all areas of business including Human Resources. Human Resource Management is no longer limited to recruitment and training. It has become an indispensable part of every organization. Technology and Human Resource Management are closely associated to each other. Information Technology has significant impact on increasing the efficiency of recruitment, maintenance, development and decision-making functions.*

Keywords: *Science, Technology, Effective, Human Resource Management*

1. Introduction

Human Resources Management is the terrn used to describe formal systems devised for the management of people within an organization. The responsibilities of a human resources manager fall into three major areas: staffing, employee compensation and benefits, and defining/designing work. Essentially, the purpose of Human Resources Management is to maximize the productivity of an organization by optimizing the effectiveness of its employees. This mandate is unlikely to change in any fundamental way, despite the ever-increasing pace of change in the business world. As Edward L. Gubman observed in the Journal of Business Strategy, "the basic mission of human resources will always be to acquire, develop, and retain talent; align the workforce with the business; and be an excellent contributor to the business. Those three challenges will never change."

A brief description of the challenges before Human Resources is given below:

1. Hiring is likely to be on rise and this would mean, competition for talent will increase.
2. Human Resources people can spend more time on the human aspects of the workplace, and less time chasing papers and emails.
3. Comprehensive Human Resources tools coupled with stunning point solutions for recruiting and performance management are coming of age and are increasingly accessible to smaller organizations.
4. As the Technology improves and education makes its way, organizations will have more cost-effective options and will be able to put more choices into their employee's hands.

1.1 Principles of Human Resources Management

Perhaps the paramount principle is a simple recognition that human resources are the most important assets of an organization; a business cannot be successful without effectively managing this resource. Another important principle, articulated by Michael Armstrong in his book A Handbook of Human Resources Management, is that business success "is most likely to be achieved if the personnel policies and procedures of the enterprise are closely linked with, and make a major contribution to, the achievement of corporate objectives and strategic plans." Other Human Resources Management factors that shape corporate culture; whether by encouraging integration and cooperation across the company, instituting quantitative performance measurements, or taking some other action are also commonly cited as key components in business success. Human Resources Management summarized Armstrong, "is a strategic approach to the acquisition, motivation, development and management of the organization's human resources. It is devoted to shaping an appropriate corporate culture, and introducing programs which reflect and support core values of the enterprise and ensure its success.

1.2 Position and Structure Of Human Resources Management

Human Resources Management functions are ideally position near the theoretic center of the organization, with access to all areas of the business. Since the Human Resources Management department or manage is charged with managing the productivity and development of workers at all levels, human resource personnel should have access to and the support of key decision makers. In addition, the Human Resources Management department should be situated in such a way that it is able to communicate effectively with all areas of the company. In recent years, however, observers have cited a decided

trend toward fundamental reassessments of human resources structures and position. " A cascade of changing business conditions, changing organizational structures, and changing leadership has been forcing human resource department to alter their perspectives on their role and function almost overnight, "wrote John Johnston in Business quarterly.

"Previously, companies structured themselves on a centralized and compartmentalized basis; head of office, marketing, manufacturing, shipping, etc. they now seek to decentralize and to integrate their operations, developing cross-functional terms". Today, senior management expects Human Resource to move beyond its traditional, compartmentalized 'bunker' approach to a more integrated decentralized support function.

2. Survey of Literature

A number of studies have been made and many books have been written regarding the role of IT on Human Resources Management. The use of information technology in Human Resources has grown considerably in recent years. A review of Literature reveals that the role of Information Technology in Human Resources Management can be traced in the last decade of 20th century.

Ruel (2008) have explored that the term e- Human Resources Management was first used in the late 1990's when e-commerce was sweeping the business world and e-Human Resources Management is internal application of e-business techniques. It helps to manage an increasing number of Human Resources Management processes in an effective manner with the improved information technology, thereby contributing to the availability of information and knowledge. This in turn helped Human Resources Management professionals to play a strategic role in attaining improved competitive advantage.

Attracting, retaining and motivating employees, meeting the demand for strategic Human Resources function, and managing the "human element" of technology change in the future has been enabled by advancement in Information Technology to the challenges of Human Resources Management (Ashbaugh and Miranda, 2002). Human Resources Management can meet the challenge of simultaneously becoming more strategic, flexible, cost-efficient, and customer-oriented by leveraging information technology (Snell, Stueber, and Lepak, 2002).

Adewoye, 2012 in his paper "The impact of Information Technology (IT) on Human Resources Management (HRM): Empirical evidence from Nigeria Banking Sector – Case Study of Selected Banks from Lagos State and Oyo State in South-West Nigeria" has mentioned that the interaction and intersection between IT and HRM lead to the emergence of HRM. It merged all HRM activities and process with the information technology field while the programming of data processing systems evolved into standardized routines and packages of enterprise resource planning software.

Walker (1982) states that an Human Resource Information System is a systematic procedure for collecting, storing, maintaining, retrieving and validating the data needed by an organization for its human resources, personnel activities and organization unit characteristics. It can support long-term planning in relation to manpower. It includes supply and demand forecasts, staffing, separations and development with information on training program costs and work performance of trainee. It can also support compensation programs, salary forecasts, pay budgets, employee relations, contact negotiations etc. communication and information technologies have added value to Human Resource applications which helped in developing a human resource information system.

Pinsonneault, 1993 observed that the use of IT in HRM to organization has helped to free the HR staff from routine roles and enable them to concentrate on strategic planning in human resources development. In the present context of increasing globalization, Tensely and Watson (2000) observed that the organizational environments have become increasingly complex. Managers in these organizations face growing difficulties in coping with worker forces as they are spread across a variety of countries, cultures and political systems. Managers can utilize IT as a tool in general as well as human resourcing functions in particular to increase the capabilities of the organization.

2.1 Statement of the problem

Many researchers have been undertaken in the past to study the changing role of HR function. Hr is no longer now restricted to procurement of manpower. HR professional are rather involved in complete transformation of HR processes with the use of latest technology. The use of IT in HR is likely to reduce cost, improve service, and achieve effectiveness. Keeping these facts in mind, the present study has been undertaken

2.2 Methodology

Secondary data has been for the present study. The secondary data has been collected from extensive desk research through library, different published materials and the world wide web.

The study has been made to examine the IT tools used for HR Planning, Recruitment, Communication and Engagement, Maintenance and Development.

2.3 Objectives of the Study

The study seeks t explore the answer of the following questions:

1. What are the functions performed by the traditional?
2. What changes have taken place in HR function in the recent past?
3. What is possible role of HRIT on the changing HR function

2.4 Significance of the Study
The study is of great significance to the business organization as it highlights the various technological tool applied by HR professional from time to time, the changing role of HR and likely impact of technology on HR.

2.5 Analysis and Interpretation
To achieve the above objectives, the study is divided into two parts:

A. Traditional Vs. New HR Functions
B. Role of Technology in HR

3. Role of Information Technology in Human Resource
The globalization and liberalization on the one hand and technological advancements on the require the business organizations to rethink the role of their Human Resource function. The Human Resource professionals should effectively utilize the information technology for developing competencies of the people to face these challenges and for the growth of the business as well. The application of information technology can make value-addition and raise the status of the Human Resource professionals as a whole. The business world is becoming more and more competitive and faced with new challenges each day including business environmental change, technological change, customer satisfaction, growing competition and issues relating to reduction in cost and increase in productivity. It is the people who can meet the challenges of the present day market.

The technological advancement has been driving force for creating new roles for the Human Resource function to improve their business competence. Human Resource Information technology has made it easier for the Human Resource department to integrate their databases, and provide information on the policies, news, and publications etc. It is the simplest form of implementation of the Human Resource Information Technology which could be accessible by anyone, anytime and anyway within the organization. It has also enabled the employees to update the information and thus, relieved the Human Resource professionals of the burden of maintaining and storing records.

4. Conclusion
1. There is a shift in HR function from personnel function such as recruitment, selection, training and development, performance appraise, rewards to consultative strategic business issues and policy formulation to some extent in 80's.
2. The scope of HR activities was winded in 90's with HR professional performing the role of strategic business partner, change agent, administrative expert and that of employee champion
3. 3 During the .first decade of 21st century, Human Resource professionals was assigned new roles including strategy partner, functional expert, employee advocate, human capital developer and Human Resource leader with wide range of activities as mentioned by Ultrich. Later, the globalizations and liberalization policies and increasing use of Information Technology in Human Resource, Human Resource professional is now performing the role of Strategy Maker, Organization Developer and Internal Consultant continuously monitoring Human Resource strategies and policies, keeping a track record of employee till retirement, managing employee talent and passing instructions on Human Resource issues.
4. 4.The task of Human Resource professionals has been simplified with new technological tools, communication technologies and new application software have made and they can now spend more of their time on policy framework, strategic planning and other such issues.
5. Various HR function of HR can be effectively managed through the use of computers and IT tools..For example, the function of recruitment, employee selection, employee management and workforce planning are managed through internet, web portals, video conferencing, data warehouse etc., training, maintenance and performance evaluation, feedback ,employee turnover, tardiness and absenteeism analysis, management and planning functions, succession planning etc. through Internet, Intranet, employee portals, and company portals etc.

It appears that the role of technology in HR management is likely to increase in the coming years. The significance of HR function in the organizations has increased much in the last 20 years .New roles are likely to be added with the changing scenario. Talent acquisition, competency mapping, never appraisal systems like 30 degree feed forward, retention, contractual, compensation, employee engagements ,reward etc. are the new roles being added. Never software and technological tools will certainly help the HR professional in these new assignment. Nevertheless, the role is HR has become more challenging in the organization.

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THE TEAMWORK DYNAMICS IN UNIVERSITY ENVIRONMENT

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Abstract: *This paper focuses on the topic of teamwork. To be more precise, it focuses on assembling and managing of small teams of employees or students who are asked to work together on a specific project. The teams are asked to solve a unique problem together and to create a document summarizing their work and presenting their solution. Some of the teams were assembled randomly, some were assembled by participants themselves and others by the Belbin team role method. The main goals of the paper are to present theoretical background on the topic of teamwork, to study the teamwork dynamics in assembled teams and to find out if the different assembling methods had an impact on the performance of teams.*

Keywords: *teamwork, team management, project management, team roles, team dynamics*

1. Introduction

The needs of businesses have evolved in the past decades. While the traditional needs for skilled production and administrative work force have stayed, modern companies are looking also for other kind of employees. Employees who are capable to work effectively in project teams and focus on solving new and complicated problems of the company and not just the routine ones. This way the company can innovate more effectively and grow faster. But even educated, skilled and creative employees might not bring the expected results when they don't know how to work as a team. Many times, employees function only as individuals forced to work together and not as a team. Teamwork can create synergy between the individual employees and bring an added value to every project. To achieve this teams must be precisely assembled and managed all through the common project.

The same principles also apply in the university environment. Students are often asked to work in teams and solve a common problem together. But not so often are the student teams assembled and managed with the principles of teamwork in mind. If the students are taught the basic principles and rules of teamwork, they can more easily apply them later in their careers. This way the university graduates can by more successful and reflect better on their university.

2. Team and teamwork

Many authors have tried to appropriately define team. Based on one of these definitions [1] we can say that team is a collective of people, who were assembled to perform some organizationally relevant task. The members of the team must share one or more goals, carry out social interactions with other team members, maintained and manage boundaries and work on interdependent tasks. Team should by established by the organization and interact with other units inside the organization.

For the concept of teamwork to work it is necessary to promote and encourage values supporting the team culture inside the organization. These values are for example ability to listen and respond constructively to the views expressed by other team members, providing others with the benefit of the doubt, ability to appropriately support others and recognizing the achievements and interests of others. [2] Values like this are of high importance for a project-oriented team because they help to improve cooperation and communication between the team members what is necessary for the creation of synergy effects inside the team. [3,4] They also help to create a positive and innovative climate inside the team. According to West a positive and innovative climate is a crucial prerequisite for the team's success and it helps team members to work more efficiently and creatively. Based on West's model of team climate there are four most important factors influencing the team climate. They are: support for innovation, vision, task orientation and participative safety. [5]

On the other hand, it is necessary to mention that the topic of teamwork is very complex and, in some instances, even well-established teams with an advance team climate and culture could may not accomplish their task successfully. This situation may be partially explained by the fact that team performance depends not only on the competence of the team itself, but also strongly on the broader organizational context in which the team is operating. [6]
Based on the paper studying the teamwork dynamics over time [7] it is possible to establish some general set of phases or stages of teamwork. These phases are called: forming, storming, norming, performing and adjourning. In the first phase the team is formed and its members are concerned and anxious about their acceptance, so they may try to act politely and enthusiastically. Individual members also rarely know each other well which leads to a lack of trust inside the team. During the storming phase usually a conflict arises. Individual members are trying to find their place and role inside a team and a compete for influence. In the next phase the conflict is resolved, team rules are established, and team members start to act as a member of a bigger team. This normalization is channeled in the

phase called performing. Here most of the results expected from the team are created and the efficient work is done. After the task is finished, comes the last phase of teamwork. In this phase the work is done, and the project team is dissolved. Which should bring both the sense of satisfaction and sadness to the individual team members. In ideal circumstances team members are assign to a new team with new people and goals, in which the phases repeat themselves. [8]

2.1 Teamwork model

Many authors have tried to describe the processes and components occurring during the teamwork dynamics. [9,10,11] One of the most generally accepted model of teamwork dynamics is the Dickinson and McIntyre model. [12] The graphical representation of this model looks like this:

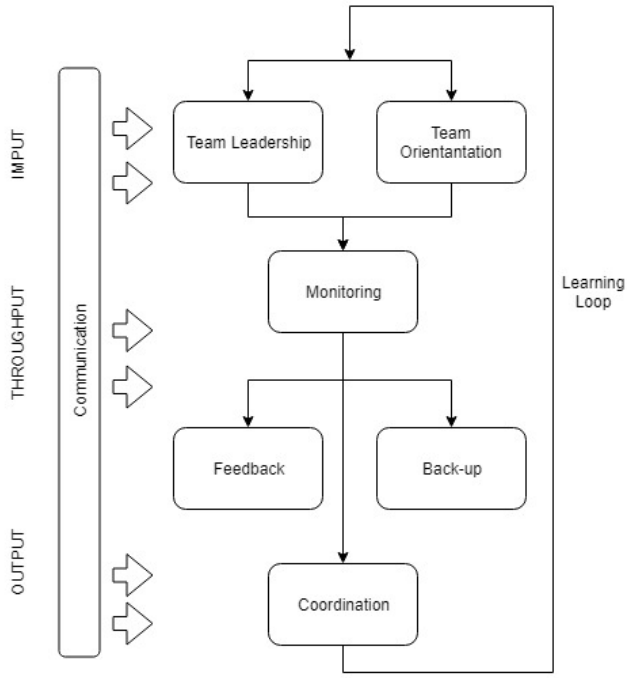

Figure 1: The model of teamwork by Dickinson and McIntyre [12]

Dickinson and McIntyre model is based on the definition of 7 core components of teamwork and the relationships between them. The seven core components are: communication, team orientation, tam leadership, monitoring, feedback, back-up and coordination. All these components are supported by the learning loop designed to periodically improve the whole process.

The core components of the model are sorted into 3 categories. Team orientation and team leadership are input components, because these components are necessary for the individual team members to participate on the tasks of the team. Monitoring, feedback and back-up are intermediate or throughput components and are design to ensure that the teamwork will be carried out efficiently. The final component coordination is perceived as an output component because it defines the whole performance of the team. All 6 other components are supported by communication, which transcend all three categories. [12]

Said model was chosen as a basic framework of teamwork in this paper. Which means that chosen student project teams were taught to try and set their teamwork dynamics according to the model. This particular model was chosen because it sufficiently represented the theoretical background of teamwork and also because it supports the unique team processes used by the student project teams.

2.2 Team assembling and team roles

All 7 components of teamwork depicted in the model are focus on team activities after the team has been assembled. Team assembling is a crucial part in effective teamwork management and has a significant effect on the teamwork performance. It represents the process of choosing the right individual members of the team, so they can create the best synergic effects and reach the goal set for the team the most efficient way. [13]

One of the most widely accepted framework for the team composition, development and management is defined by Belbin. [14] Belbin says that the team success does not depend so much on factors like experience, skills and intelligence of individual team members, but it depends more on their behavior. Behavior represents the way the team members use to make decisions, to interact with each other and to apply their individual capabilities in the context of teamwork dynamics.

All these characteristics are vital for the positive team climate and its effective performance. Based on Belbin the behavioral tendencies of individual team members or their prerequisites to interact with others a certain way can be standardized into basic “team roles”. While the individual skills of members are still important according to Belbin more important is the harmonic distribution of individual team roles among the team members. [15]

The nine basic team roles according to Belbin are [14,16]:

- **Resource investigator –** team member with an ability to find outside ideas and resources and bring them to the team.
- **Teamworker –** someone versatile and driven to find necessary unfinished work and finish it on behalf of the team.
- **Co-ordinator –** team member who helps others focus on the objectives, engages other team members and delegates workload appropriately.
- **Plant –** creative engine of the team responsible for finding new and unconventional solutions for team problems and tasks.
- **Monitor evaluator** - team member responsible for logical and impartial way of deciding team judgements.

- **Specialist** – person with deep and accurate knowledge of the area studied by the team.
- **Driver –** provides the drive and momentum to the team activities needed for an efficient team performance.
- **Implementer** – plans the team strategy and finds the best way to carry it out.
- **Completer/Finisher** – responsible and thorough team member who carries out the final quality check and looks for possible errors.

The ideal team should include all nine team roles. One team member can fill more than one team role at the time, depending on his personal behavior characteristics. [15]

Individuals can find out their team role affiliation by taking the Belbin team role test. In this test they answer a set of question about their typical team behavior.

3. Teamwork dynamics in university environment

At the start of the semester 71 students were presented with a unique and new problem to solve as a team. Subsequently students were divided into 4 groups. In every group four team were assembled based on different criteria. Different groups also used different method of team management. Interviews and a basic questionnaire were used to obtain information about the internal dynamics of the studied teams. For example, a teamwork score was determined for every team based on the questionnaire assessment of individual team members. Team performance was quantified on team's ability to solve the problem given to them at the start of the semester. The study of teamwork dynamics in the four groups is still ongoing, but the first phase already produced interesting primary results. Some of the primary results can be seen in the Table 1 below.

Table 1 Primary student teamwork results

Indicator	*No. of teams*	*Average teamwork score*	*No. of team conflict situations*	*Average performance*
Group 1	4	7,3	3	82,27
Group 2	4	8,4	1	84,69
Group 3	4	7,8	0	84,93
Group 4	4	8	1	75,53

3.1 Group 1

In the first group of students four project teams were assembled. The individual team members of the teams were chosen completely randomly. No other team composition method was implemented. The teamwork management was left almost completely on the teams themselves and their individual members.

Because of the random method of team composition students with clashing behavior traits ended up in the same team. This fact resulted in several conflict situations among the individual team members. Conflict also influenced the self-assessed teamwork score which was lowest from all four groups. On the other hand, the final average team performance did not suffer so much, which poses a question for a future research.

3.2 Group 2

The students in the second group took the Belbin test and were carefully placed into 4 teams based on their team role results. Teams were assembled so all 9 team roles are represented and in harmony. The Dickinson and McIntyre model was also presented to the teams and they were encouraged to manage their team in accord with the seven core components of teamwork.

During the first phase of teamwork dynamics study only one significant conflict accrued in Group 2 and the teamwork score based on questionnaire answers were highest from all four groups. The average team performance of Group 2 was also very high.

3.3 Group 3

Group 3 was also given the Belbin test of team roles. Based on the results four teams with a harmonic distribution of team roles were created. The difference from the previous group was that they were not encouraged to use the Dickinson and McIntyre model of seven core components of teamwork.

No significant inner conflicts were documented in this group and its average team performance was the highest from all four groups. On the other hand, their teamwork score was only 7,8.

3.4 Group 4

The last group was given a free hand in team composition. That means that the students were free to assemble 4 teams based solely on their personal preferences and relationships. But when it comes to the team management and processes, they were encouraged to follow the example of the Dickinson and McIntyre model of seven core components of teamwork.

The results of this group were mixed. Even though they teamwork score was relatively high and only 1 significant team conflict was observed, the average performance of the group was well below the other three groups. The low average performance was caused by an unbalance of four teams in group four. While in the previous three groups the team performance of all 4 teams was relatively similar, in Group 4 there was a big difference in performance of the best and the worst team. This big difference lowered the group's average performance.

4. Conclusions

The right combination of individual team members followed by an efficient way of team management are very important prerequisites for a successful teamwork dynamics. Successful teams are especially important for businesses with a project management business model. These businesses depend on the efficiency of their project teams and their ability to tackle new and complicated problems.

But a knowledge to manage teamwork efficiently can also be very beneficial in the education and more specifically in the university environment. Students who know how to choose and manage their team can learn, more achieve more and most importantly be more successful in their future careers.

In this paper a study of 71 students was introduced. Even though the study is still ongoing some primary results are already available. Primary results showed that the average team performance of teams assembled based on their team roles is better than those assembled by different methods. Significantly lower was the average performance of teams assembled by students themselves based primary on their friendships and personal preferences.

Primary results also pose new research questions. For example: How severe is the effect of team conflicts on the team performance or the team climate? How to avoid these conflicts? What are the most important components of teamwork management and teamwork dynamics? And so on.

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INNOVATION MANAGEMENT IN CAMERA INDUSTRY

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Abstract: *Innovation management and the need to manage the innovation process in enterprises is becoming increasingly common. Although innovation management has been known for several years, not all enterprises have the same access to information and do not use all available options for effective innovation management. enterprises are often lost in this process and do not have a clear system, or at least principles that would provide the right environment for creating innovative ideas, making them practical and then using them on the market. For many businesses, it may be a good choice to track the most successful businesses on the market, including Canon. This company is one of the world's most innovative companies in the field of optical solutions, cameras, printers, and medical equipment. The aim of this article is to point to theoretical principles that, when properly interpreted in business practice, can bring the ability to understand the correct way of innovation management in enterprises. The article explains the theoretical bases with reference to a more detailed issue in the literature on innovation, innovation management and patents. Consequently, some of Canon's principles that help successful innovation management and the proper management of this area are explained.*

Keywords: *innovation management, innovation, camera, patent*

1. Introduction

Innovations are a very important part of success for organizations. It is important to know why changes occur and why companies are innovating. The basic function of innovation is to differentiate the organization from the market by something extraordinary. The starting impulse of business effort is to respect the needs and interests of customers. Entrepreneurs must look for resources of innovations and find new changes that are a sign of successful innovations. Most customers consider new products or services as the biggest buying incentive.
Innovation management is at present essential part of every company's comprehensive strategy. Innovation and innovation management is a tool of competitiveness that involves several areas of company management, and it is therefore essential that innovations pay significant attention to the active implementation of knowledge management. This contribution redefines knowledge management as a tool for creating a knowledge-enhancing environment within a company's corporate innovation machine.

1.1 Innovation

Chris Freeman describes innovation in a relationship with using of a new idea: "Innovation includes engineering, design, manufacturing, management and business activities, which relate to the placing of the new (or improved) product or the first commercial use of a new (or improved) process or management on the market." [4]
Innovations do not necessarily have to be commercialized for a major new one technology (radical innovation), but it also includes the use of less fundamental changes in technological know-how (incremental or incremental innovation). [9,11] In this way, any improvement and innovative approach can be implemented in the field of innovation, if it promotes positive change.

Innovation is a specific tool for entrepreneurs, which creates an opportunity to distinguish their business or services. Innovations are capable of being presented as a science branch, capable of being studied, competent to practice. [3] Innovations are currently undergoing a great deal of research to help successfully manage innovations and improve the innovation process in enterprises.

Companies achieve competitive advantage based on an innovation act. [8] An innovative enterprise is one that thinks and acts in all ways differently than others. This is not just good ideas, it's a combination of good ideas, motivated workers and an in-depth understanding of what customers want. [12] In this way, Branson points to the importance of innovation management, innovation is not important in itself, but especially in the context of the business in which it emerges and develops.

According to the OECD [9], the concept of innovation is understood to include renewing and expanding the range of products and services and associated markets, creating new methods of designing, manufacturing, supplying and distributing, introducing changes in management, organization labor and working conditions and skills of the workforce and covers the technological, non-technological and organizational innovations.

Čimo [1] describes few factors, that effects the importance of research and development:

- Customers prefer the novelty of products and services and a strong buying incentive
- With the same technology and business conditions, as the result of globalization, innovations are the most important source of competitive advantage

- The general trend of processing innovative product cycles as services in response changes in needs and business conditions
- Products and accompanying services are increasingly complex, have complexity interdisciplinary relations (new materials, information technologies, environmentalism, design configurations, socio-economic factors, etc.)
- Research and development as the creation of knowledge values with high added value and market potential.

Table 1 Classification of innovation degrees [2]

Innovation degree	*Label*	*What is preserved*	*What changes*
-n	Degeneration	-	Less features
0	Regeneration	Subject	Restoration of features
Rationalization			
1	Intensity	All properties	Number of features
2	Reorganization	Quality and relationships	Speed of operations
3	Change of quantity	Qualitative properties	Division of operations
4	Qualitative adaptation	Quality for users	Connections to other factors
Qualitative continuous innovations			
5	Variant	Construction solutions	Sectional quality
6	Generation	Construction conception	Construction solution
Qualitative discontinuous innovations			
7	Type	Principles of technology	Construction conception
8	Genus	Belonging to the phylum	Technology principle
Technological take-over – micro technologies			
9	Phylum	-	Basic approach

Showed table describes the classification of innovation degrees. First there are degeneration a regeneration, which represents the situation without innovative ideas.

Next degree of rationalization makes the necessary change and in qualitative continuous and discontinuous innovation stage, described product or service gets new way of construction realization and principles. Technological takeover creates the all-new product.

1.2 Innovation management

Innovation management is the discipline of management, the process of research, development and innovation. It can develop products as well as processes in the organization. The focus of innovation management is to enable an organization to respond to internal or external opportunities, including through creative efforts to create new ideas, processes or products.

Innovation Management is a comprehensive management tool for effectively managing innovation processes in a business unit. The main task and goal of innovation management is to rationally and efficiently manage innovation that responds flexibly to customers' needs in a harmonious way with the needs of manufacturers. The result of complex innovative actions is products and services with maximum value for the customer. Teamwork, creative spirit and vitality play a major role here. [5]

Innovative management is about performing activities that can drive the innovation process in an active way. Innovative management is not a spontaneous (voluntary, unquenchable) process. [7] This is an intense activity in an innovation company. However, innovative business activities are now becoming part of the overall business culture. The role of management is to uncover business changes and prepare people to accept and make the necessary change in the business. Business management has a long-term approach to company management in time and therefore includes innovations in its strategies.

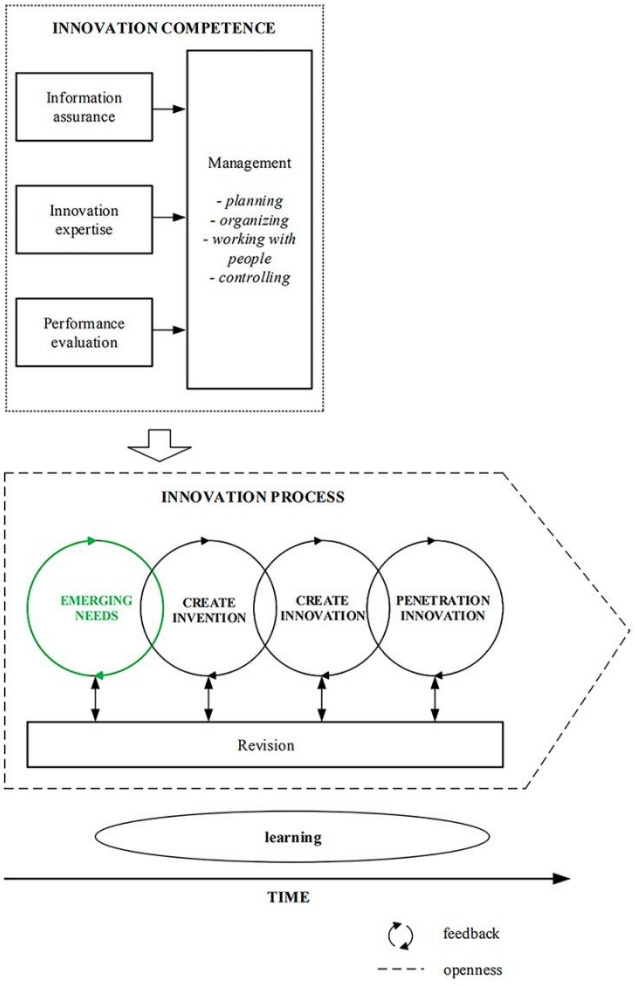

Figure 1 Management innovation processes model in company. [6]

This model describes two approaches. First it represents competences that need to be built, and second it is a process that needs to be implemented in company. Therefor is this model made up from two main parts, specifically innovation process and innovation competences. [6]

To identify it there is any innovation opportunities in processes, there are many techniques, that describes steps to create and implement new ideas. One of them was described by Theodore Levitt, and it is called "Jobs to Be Done (JTBD)". He said: "People don't want a quarter-inch drill; they want a quarter-inch hole," and he explained, that people buy products and services to accomplish a task or achieve a goal. [10]

1.3 Patent

Patent (invention) is a protective document for the invention, the industrial-legal protection of all technical solutions, products, production methods and devices that are new, industrially usable, have a certain technical level and are registered in the Office patent register. The effect of the patent registration is to grant the owner an exclusive right (absolute) to use the patent in the specified territory.
According to Business Dictionary is patent defined as limited legal monopoly granted to an individual or firm to make, use, and sell its invention, and to exclude others from doing so. An invention is patentable if it is novel, useful, and non-obvious. To receive a patent, a patent application must disclose all details of the invention so that others can use it to further advance the technology with new inventions. [13]

Within the innovation performance, there is used patent ranking in countries or businesses to identify the value of innovation performance. This value determines how many patents a country or company has patented for a given period. For this purpose, the Innovation Scoreboard, which is published each year by the European Commission, is used in the range of countries, and in the field of business, it is a list of registered patents organized by the Patent and Trademark Office.

2. Analysis of innovation management in Canon Inc.

According to Canon CEO Fujito Mitarai Innovation has been a key ingredient in Canon's success throughout history. Canon is one of the most prolific inventors of consumer and professional imaging solutions. Canon Inc. ranked umber 3 worldwide among all companies issued U.S. patents in 2017. Some products developed from Canon R&D and patented technology include the laser beam print engine, Bubble Jet Printing systems, plain-paper copying devices, eye-control focus systems for cameras and camcorders, and optical image stabilization for video cameras, broadcast lenses, and binoculars. [15]

Table 2 Patent ranking [14]

Ranking	*Company*	*Number of patents*
1	IBM (U.S.)	8088
2	Samsung Electronics (Korea)	5518
3	Canon (Japan)	3665
4	Qualcomm	2897

For innovation management Canon uses The Advanced Technology Business Unit (ATBU). ATBU was established to create a strong marketing focus for all Canon R&D activities in Europe. Incorporating two R&D sites in France (Canon Research France) and England (Canon Research Europe), the ATBU aims to turn every innovative technology into a commercial venture. Although the focus lies in creating new market opportunities for Canons Business Units, mainly in Europe or on a global scale, Canon also offers new technologies to third party companies. [17]

Harryson focuses on four main principles that are the cornerstone of successful Canon and Sony product innovation. [18] These companies are using systems as: strategic training and rotation for employees, use of research and development management information systems, linking research and development and production development teams with manufacturing and extensive communication between providers and centers of excellence.

Canon Innovation Management is organized through an employee integration mechanism through an initial three-month program. At the start of the work, a research center employee is assigned a production line for a three-month period. Here, you can find number of shortcomings, characteristics, and product specifications that need to be upgraded. This system is called initial training in the enterprise.

An undergraduate training system for engineers and manufacturing researchers is also being carried out in a competing company Sony, where workers work for one month at a production line.

Employees are also committed to effectively and successfully implementing innovations in the manufacturing and business process of training in marketing, sales and commerce.

Based on this way of managing innovations and managing research and development staff, it has been demonstrated that employees have been able to translate almost all innovative designs into commercially viable products or technology after these training sessions. For making Canon innovation available, Canon has often chosen a similar strategy. Perceived innovations to customers were not always just a new product or technology. Hrestatt describes Canon's ways of reusing the technology that has already been tested, in a way that the customer perceived change as an innovation. [4]

An example of this use of the technology already in use is the use of Dual Pixel Auto Focus (DPAF) technology. This technology was first used in the Canon 70D when it

revolutionized the focusing system of camera in live view mode. However, these upgrades have been implemented later in the professional 5D and 1D camera range where enhanced focus options for professionals have been introduced. The technology that has already been tested has become a novelty by utilizing a different segment.

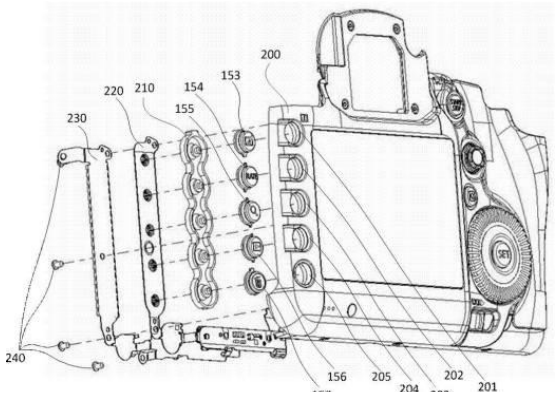

Figure 2 Patent for Canon illuminated buttons. [16]

A similar example is the use of touchscreens and backlit buttons on cameras. Although the use of backlit buttons has been common for computers, telephones and other electronic devices for decades, this technology may also be a patent for Canon cameras in 2017.

In this way, innovations through a well-designed employee rotation process, where developers have opportunity to experience real technology production, become efficient and functional. Subsequent patenting and transferring an idea into an accomplished business strategy is the main clue to successful company innovation management.

3. Conclusions

Over the last few years, innovation management has become a regular part of businesses. In connection with learning processes, it is effective for enterprises to identify the best practices on the market.

Canon is among the most innovative companies in the world, with an innovate management system and the associated problems creating an excellent basis for further development. The system of rotation of employees in the workplace and the possibility for employees to contribute actively to the created product, thus creating an appropriate solution for the necessary innovation ideas and their successful use in business practice.

Acknowledgement

This paper was supported by the Slovak scientific grant VEGA 1/0363/14 Innovation management - processes, strategy and performance.

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THE TALENT MANAGEMENT AND HUMAN CAPITAL IN THE KNOWLEDGE-INTENSIVE INDUSTRIES

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Abstract: *Human capital theory and human capital management can be viewed as a supplement and extension of human resource management that is being performed in a certain form in all enterprises around the world. It is about coming up with applicable measures and indicators to be able to manage the asset of people's skills, knowledge and constructive behaviours. This topic can be broadened and interrelated with the concept of talent, its management, and the underlying element of competencies, discussed in literature, research works, and applied in business practices. The aim of this article is to present some of the parts of the talent management, particularly oriented on the knowledge-intensive industry. The topic is also linked to the modern information technology that can support the activities of the talent management for gaining better results.*

Keywords: *human capital, talent management, competency, knowledge-intensive industry*

1. Introduction

The current economic and business environment is often described as the knowledge economy from the overall perspective. It is knowledge what generates high amounts of value and profit in various industries. This especially applies, for example, for enterprises operating in IT sector. Alvesson [1] stated that: "the competence of employees is the main resource of knowledge-intensive firms". Since knowledge and competencies are inseparably connected with people – employees in enterprises, there is a lot of attention paid in academic research and in practice to theories improving their management. Here belongs the theory of human capital, and also a topic closely related to it – the talent management.

Garton [2] puts the talent management topic into connection with the investment in human capital. He says that there are obvious investments in human capital in the form of increased wages, education and training, or improved healthcare for employees. But he also identifies other, less obvious, forms of these investments in giving the employees time and space to explore new ideas and providing them with the opportunities of professional development. He justifies such investment by the fact that the top-quartile companies in the study he conducted with Michael Mankins unlocked 40% more productive power in their workforce by implementing better practices in time, talent and energy management.

2 Talent management

Collings at al. [3] define the talent management "as the process through which organizations anticipate and meet their needs for talent in strategic jobs." They add that strategic jobs can be located anywhere in the organization. It depends on its strategic objectives and competencies. In this article, some of the aspects of talent management are studied in knowledge-intensive industries, as it is depicted in Figure 1 (HRIS = human resource information system).

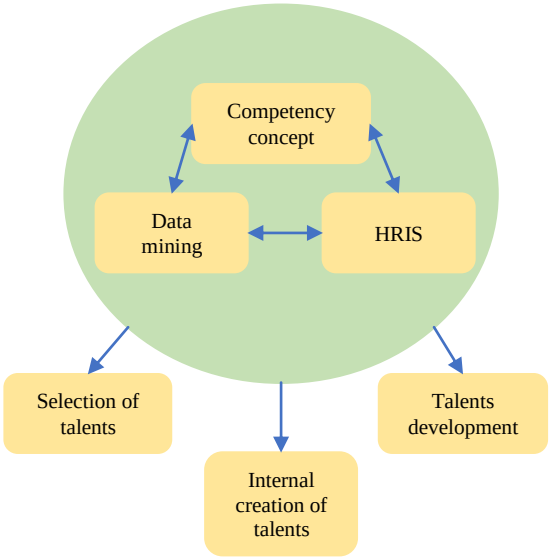

Figure 1: Selected aspects of talent management

Authors Cui, Khan and Tarba [4] identified that, in general, two differentiated approaches for the talent management can be found in literature and in practice of enterprises. Selective point of view is applied when an enterprise considers only a small number of its key employees as the true talent. Its opposite is inclusive approach when the majority of employees are seen as the key ones, and thus they are treated as valuable talent. The selection of one of these two perspectives of the talent management itself impacts the way of performing its individual activities, having influence on the efficient use and development of the overall human capital in an enterprise. Preference of one of the mentioned approaches by managers can be caused by various factors. One of them is also the industry in which the enterprise operates. The authors processed multiple cases from small and middle-sized enterprises in the service sector in China. According to the words of manager from an enterprise operating in the field of information and communication

technology: "talents are people who have creativity and enthusiasm in the professional field and who achieve their work objectives completely in order to create more value for the company." It is more natural for enterprises conducting the business in knowledge-intensive industries to consider all their employees as talents, and so using the inclusive approach to define talent and to manage it as well.

3. Competencies in talent management

Effron and Ort [5] see competencies to emerge in almost each activity of the talent management. They are connected with the performance assessment, career development planning, and with the training programmes too. However, authors warn that if the competencies are treated as too complex and intricate models with very high level of detail, managers either ignore them or they do not understand them at all. The detailed studying of the competencies needed in an enterprise follows the logic that identifying the skills and behaviours related to a job allows to develop and motivate desirable results and it helps with the assessment of employees. The difficulty is to recognize the point when the further level of detail only adds complexity but no value. Even though, the authors are convinced that the appropriate application of the competence concept has a huge potential to increase the emerging of true talents in an enterprise. It is again connected to the approaches to the talent management (selective or inclusive) that were listed above.

4. Specific CSFs for talent management

Since it was established that the issues of talent and human capital need to be efficiently managed, it is necessary for enterprises to set some indicators – critical success factors (CSF) – also for these issues. Enterprises could probably come up with many things they would be able to track thanks to modern information systems. But to decide what data can really bring valuable pieces of information for directing the next efforts, SAP [6] recommends setting such indicators that monitor the ability of enterprise to realize its strategy, generate income, and manage costs or risks. The talent management topic is related to the activities of workforce planning, employees' hiring, and employees' development. Therefore, when constructing these CSFs, enterprises need to focus on the gap of skills needed and skills currently available via the employees, ratio of internal and external hiring (related to the opinion of Sturgess stated later), and the quality and amount of hiring for the key positions. Interesting here is also to monitor the percentage of newly hired employees that are fired during the first six months. Valuable insight into the talent management activities is gained also by tracking the percentage of employees with low performance whose performance got better within a year as a result of individual development efforts. Another recommendation is to assess what percentage of employees participating in a specific training use the specific skill or knowledge in their work. Better future direction can be achieved also by looking into what weight has the employees' development in the assessment of managers. Looking for new ways of evaluating the overall performance, including the performance pertaining the talent management, is important for being able to develop further, and to keep the pace with changes in the global business environment. Enterprises "should not forget to change their approach to the evaluation of the results achieved and focus on the use of modern methods of performance evaluation and prove to apply them." [7]

5. Selection and creation of talents

Also, the opinion of Dahooie et al. [8] is in compliance with what was stated thus far. They say that: "particularly in high-tech companies, it is of great importance to keep their competitive edge by hiring qualified staff". They see the selection problem to be lying in determining the selection criteria and their relative importance, in creating an appropriate numerical scale for evaluating candidates against these criteria, and in the deriving a comparative ranking with the use of a reliable method. In their study, they employ a competency-based approach for information technology (IT) personnel selection. They use a hybrid grey additive ratio assessment–stepwise weight assessment ratio analysis (ARAS-SWARA) methodology. They identified five competency classes for IT professionals: social competency, personal competency, subject competency (related to the professional knowledge), method competency (connected to the problem-solving ability), entrepreneurial competency (capability to assess the costs and benefits for all decisions). This study was focused on an IT consulting company. The team of experts evaluating the alternatives consisted of IT manager, HR manager and project manager with the technical expertise. Using the methodology, the subject competency and the method competency were identified as the two most important for new IT employees.

The inevitable presence of modern technologies and advances in information technology in the discipline of talent management is described also by Nedelcu [9]. He states that: "New and powerful technologies make it possible for HR to mix its internal data with unprecedented amounts of data from external sources to make talent management decisions based on evidence." Overview of the human capital in the enterprise can be gained by integrating forecasting, recruitment, implementing, developing and retaining of the human talent into a continuous cycle. The author lists data mining techniques, particularly decision trees, fuzzy logic, association rule mining and neural networks and sees their application in the activities of staff selection, employee training, employee development and performance evaluation.

Chien and Chen [10] in their research work state that: "quality of human resource is crucial in increasing the competitiveness of enterprises in high-tech industries". They applied data mining to help a large semiconductor producer in Taiwan to find high-potential talents. Extracting the hidden information from large volumes of personnel data, they discovered rules helpful for identification of effective sourcing channels to find talents.

Data mining here helped to create selection criteria for hiring new employees. A decision tree was employed to extract rules between applicants' profiles and their work. The aim was to predict the performance and retention based on the inputs obtained during employee's selection. In this case, 30 useful rules were developed as guidance for recruitment strategies to acquire new talent for the enterprise. Among some of the practical results coming from this research were the recommendations regarding the universities whose graduates have the highest potential to represent talent for this enterprise. It was also revealed that the enterprise should focus on employee's referral in the process of hiring. Lastly, job rotation was applied, so that high-performance talents were prevented from doing tedious jobs.

Sturgess [11] also emphasizes the importance of career and competency management for the enterprises, particularly for those operating in IT industry. Based on the research from Human Capital Management Institute, she states that competencies needed in the enterprise now and in the future need to be properly managed also because of the shortage of specialists in various fields (it is probably the most evident in IT). If enterprises try to drain specialists from competitors, they must offer them higher compensation. Therefore, creating future specialists internally, via development and talent management activities will eventually have positive financial effects. Plus, it supports the loyalty, because people with ambitions see that their career can develop in the enterprise if they acquire the competencies desired.

6. Development of talents

Regardless of the selected approach to the talent and its management, the talent available in an enterprise, embodied in its employees, needs to be monitored and developed to be used efficiently. Enterprises need to constantly assess the portfolio and levels of skills and competencies of their productive employees, of their talent. They need to set the goals in achieving higher levels of the skills currently held by the employees, and in acquiring new, different skills. This must be based on the overall strategy and strategies of individual functional parts of enterprises. The desired focus on developing new products, attracting and meeting the needs of new, different groups of customers, entering new markets, or on adopting new ways of operating (more efficient, more ecologic) shapes also the skillset needed to achieve these goals. Another important aspect is to get the desired future states within the skills and competencies in alignment with the aspirations, motives and limitations of the employees themselves. Therefore, the goals in the field of skills and competencies should result from the dialogue of managers and employees. Once the goals are set, an enterprise needs to find a way how to integrate the talent development activities and their monitoring into its everyday operation. Nowadays, many aspects of enterprises' operation are supported by a relevant information system. Talent management activities can be covered as extensions of the human resource information system (HRIS). Then the software can help with aligning the set of competencies held by each employee with those required by the enterprise as it is described in the work of Araújo and Pestana [12]. The software, namely the skill development module (SDM), analyses the academic and professional qualifications of employees and provides recommendations for each employee to participate in specific training actions. This module uses visual analytics which combine the automated analysis methods and interactive visual representations. The aim is to provide the results of Business Intelligence methods that are within the perception and analysis capabilities of the human user. Visual analytics use elements such as dynamic dashboards, so that information is displayed with various levels of granularity. This way, the user – employee – can access information pertaining to the skill development activities according to the preference to achieve a specific goal of the enterprise. The SDM provides recommendations for improving or achieving soft and hard skills that are relevant for the enterprise using appropriate visualization. Software solutions for talent management seek to provide a user-friendly environment for employees to either upskill or to gain new kinds of skills, participating in new training courses that suit their personal needs for development and that are needed by the enterprise in order to achieve the set goals. Appropriate software implementation with visual analytics designs the data in the way making the key information and important patterns to stand out where the graphic representation matches human visualization capabilities.

Conclusion

Competent employees represent a crucial asset for enterprises that strive for success and high competitiveness on the global market of the today's world. The theory and practices of human capital and closely related talent management can be combined by enterprises to get applicable insight in this wide topic, improving the results of human resource management, a common part of the operation of every business entity. The need to carefully work with the human capital asset is even more eminent in the knowledge-intensive industries, as it was described in this article. Competency concept can be found as the underlying element of activities such as talents selection and creation, and their further development as well. All these efforts need measurable indicators so that it can be really spoken of human capital management issues. Therefore, specific groups of critical success factors need to be identified and established in relation to talent and its management as well. Then it is also needed to decide about the inclination to more selective or more inclusive perception of talent. This represents the starting point for other relevant facets of the topic. With the application of modern information technologies, the activities of talent selection and its further development can be considerably enhanced. No future strategy in a knowledge-intensive industry can be implemented without the appropriate amount and structure of human capital or talent. Trying to fully utilize the possibilities of modern technologies in this field should become one of the priorities of every

enterprise that desires to succeed and to sustain its prosperity over the long term.

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RISK-WILLINGNESS AND RISK-AVOIDANCE AGAINST THE BACKDROP OF DECISION-MAKING

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Abstract: *Rating risks in different management questions like the evaluation of a foreign market entry is often a psychological not an analytical problem. When it comes to decision making, managers tend to avoid risks for fear of losses, even if the chance of a profit is bigger than the possibility of a loss. The benefits of a reward often are weighed against accompanying costs of obtaining it. An important component of the strategic management process is decision making that involves risk. Highly risk-averse persons choose strategies that maintain the status quo. The willingsness to take risks will be more likely to engage in behaviors that lead the decision to enter a foreign market at all. According to this strategic management decision in particular risk-willingness and risk-avoidance plays a big role in the process of choosing the best fitting market entry mode*.

Keywords: *Decision-Making, Market-Entry, Risk-Avoidance, Risk-Willingness*

1. Introduction

Rating risks in different management questions like the evaluation of a foreign market entry often is a psychological not an analytical problem. Regarding Leitl, Manager tends to avoid risks for fear of losses, even if the chance of a profit is bigger than the possibility of a loss. Fukunaga says, that when individuals make decisions, the benefits of a reward often are weighed against accompanying costs of obtaining it, and with it yield in an overall subjective value of the decision. According to the strategic management decision of a small and medium sized enterprise of how to enter a foreign market, Ojala and Tyrvainen came in their abstract "market entry decisions of US small and medium-sized software firms" to the point, that characteristics regarding to risk-willingness and risk-avoidance plays a big role in the process of choosing the best fitting market entry mode. [8][16][21][26]

2. Theoretical Background

2.1 Risk Definition

Risk researchers continue to disagree about what exactly is meant by the term risk. In entrepreneurial studies, risk has been highlighted as the magnitude of loss. Another applicable definition is "the extent to which there is uncertainty about whether potentially significant and/or disappointing outcomes of decisions will be realized". In context to risk-readiness as well as risk-avoidance and in general in context to risk management from an economic science point of view, "risk taking propensity" means the extent to which the management is willing to engage in behaviors with uncertain and significant outcomes for the firm. Sitkin and Pablo define the term "uncertain" in terms of "the variability of outcomes", lack of knowledge of the distribution of potential outcomes, and the uncontrollability of outcome attainment. Moreover, the term "significant" denotes a full range of outcomes potentially affecting the firm, both positive and negative. [6][7][13][17][19][24][25]

2.2 Risk Management

Since Girolamo Cardano's ideas about managing risks in the 16th century and the probability theory in the 17th century the risk management theories till today based on four steps:

1. Identification
2. Analyzation
3. Aggregation (calculate the overall risk for a corporation)
4. Risk response

Till today, regarding to Leitl, only a few enterprises occupy with risk management. He only mentioned one contrary example referred to Germany, that since May 1998 when the law for control and transparency in the corporate sector toke effect, German listed enterprises has to identify in a systematic way the potential risk. Regarding to Daniel Stelter, Managing Director from Boston Consulting Group, the management of enterprises are often pretty uncertain regarding to corporate risks. Stelter mentioned that an active and optimistic dealing with risks could be a competitive advantage. Additional a study by PricewaterhouseCoopers shows that only a third of all enterprises worldwide established an ERM-System (Enterprise-Risk-Management). [16]

2.3 Decision Making

Decision making is a fundamental component of human behavior. People make decisions of varying importance every day, from the commonplace to the consequential, hence guiding how our lives may unfold through the possible outcomes of our countless chosen courses of action. Many decision points involve risk, which pertains to an imperfect knowledge of the possible outcome probabilities; and uncertainty, which refers to the more general case when outcomes are tied to uncertain events whose probabilities are unknown. Lafond points out that technology has created a wealth of inexpensive, instantaneous information. An outgrowth of this increased technology is the globalization of business. This presents a real challenge for managers how to make decisions. Studies have shown that there is a variety of information

either used or available for use by managers to support them by decision making. [7][15]

2.4 Success Measured by Firm Performance

Gupta and Govindarajan tried to show a positive relationship between risk and performance. In particular the relationship between the risk taking by management and firm outcomes were investigated. Gupta and Govindarajan studied the influence of top management team characteristics and business unit strategy on the effectiveness of strategy implementation. Specifically, they studied the length of experience of the directors in sales and marketing, its willingness to take risks, and its tolerance for ambiguity. Their findings indicate that risk taking has a significant positive influence on effectiveness of strategy implementation for "build" subsidiaries and a negative influence on "harvest" subsidiaries. Later Knight, Durham and Locke conducted a laboratory experiment to test the effects of different constructs, including risk assessment on performance. One interesting finding from this research was that they found a positive relationship with managerial risk assessment and task performance. Bromiley (1991) and Bowman (1980) have also shown that managerial risk proclivities can have a positive influence on certain types of organizational outcomes. It was found that risk taking has a strong positive influence on firm performance. Risk-averse managers are not likely to become involved in groundbreaking new ventures in an attempt to enhance organizational success. Furthermore, highly risk-averse persons will choose strategies that maintain the status quo. Gilley et al. mentioned that an important component of the strategic management process is decision making that involves risk. The willingsness to take risks will be more likely to engage in behaviors that lead to process enhancements, highly competitive new products or services, innovative marketing techniques, which could inhibit the decision to enter a foreign market at all. [10][12][14]

3. Risk Management against the backdrop of Market Entry Modes

3.1 Market Entry Modes

In the course of their inquiries Chen and Messner investigated different market entry modes under the aspect of their risk potential. In particular they identify the following modes. [5]

1. strategic alliance
2. local agent
3. licensing
4. joint venture company
5. sole venture company
6. branch office/company
7. representative office
8. joint venture project
9. sole venture project and
10. BOT/equity project

Agarwal and Ramaswami points out that entry modes involve great resource commitments and change of them will cause considerable loss of time and money. With this statement they came to the result, that the entry mode selection is a very important strategic decision. In their map of the progression of mode changes as depicted in Figure 1 indicates that any transfer from a less risky and recourse committed mode to a more risk and resource committed mode is practically possible except from a transfer from joint venture company (JV) to branch office/company. There is a special transfer from more risky entry mode to less risky one. [5]

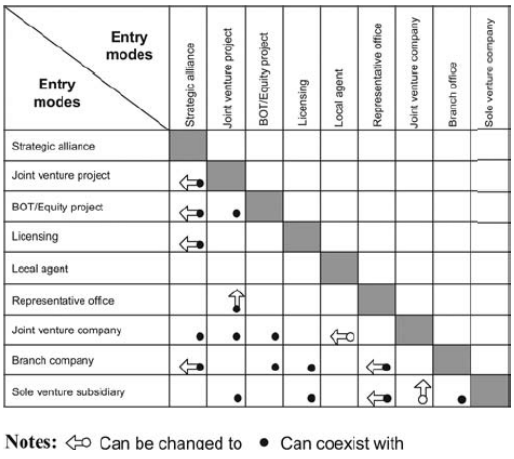

Figure 1: Transferability and compatibility of each entry mode by Chen and Messner 2011

3.2 Selection and Strategic Effects

Some researchers contend that selection of entry modes should be based on trade-offs between risks and returns, and an entrant should choose the mode that provides the highest risk adjusted return. Additional to returns and risks in a company, behavioral evidence reveals that this selection is also determined by resource availability and control need. Flexibility as well often plays an important role in determining the way of market entry. An international contractor should therefore consider the follwoging five strategic effects in a unified framework when they select an entry mode [1][5][18]:

1. risk exposure
2. return
3. control
4. resource commitment
5. flexibility

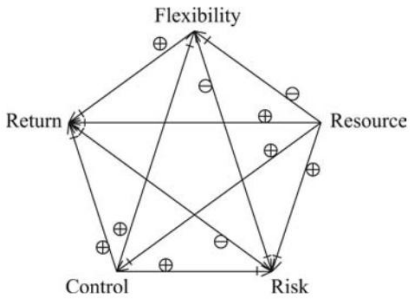

Figure 2: Characterizing Entry Modes for Markets – the Relationship between Strategic Effects by Chen and Messner 2011

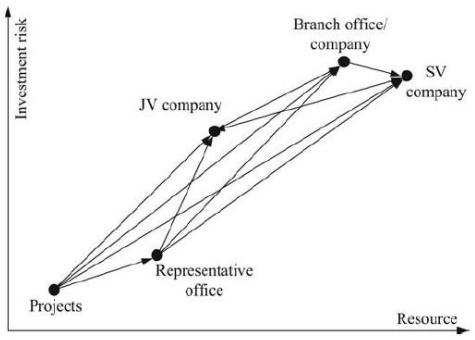

Figure 3: Evolution of entry modes in international construction by Chen, Messner 2011

3.3 Risk Exposure

Managing risks is one of the primary objectives of firms when it comes to the descion of enter a foreign market. As such, organizational strategic choices determine a firm's exposure to uncertain environmental and organizational components that impact firm performance. Therefore, the evaluation of the degree of risk exposure for each entry mode in the feasible set is very important to ensure desirable entry performance. Two kinds of risk, investment risk and contractual risk are relevant to market entry mode differentiation and selection. The investment risk in a host country reflects the uncertainty over the continuation of present economic and political conditions and government policies which are critical to the survival and profitability of a firm's operations in that country. Contractual risk reflects the uncertainty and cost of making and enforcing contracts in a foreign country. [1][5][9]

3.4 Risk Management

Murray-Webster and Hillson investigated the terms and conditions of risk management in companies in general and in situations within a group. They found out, that everyday people make decisions where the outcome matters but where the conditions surrounding the decision are more or less uncertain. Faced with these circumstances most people have developed habits and strategies that enable their lives to "free flow" for much of the time. The management of these uncertain situations that matter is also known as risk management and is a discipline in its own. It has an established role in economics as well. There is a wide range of risk management levels including management of strategic risk, corporate governance, operational risk, project risk and health, safety and the environment. [20]

3.5 Project Risk Management

A foreign market entry is a project within a management strategy. It is the operationalization of a decision taken by the management or is a result of the developed strategy plan from the company. Referred to risk management, projects are judged by their ability to meet the budget, the schedule and/or specifications and expectations of quality. Unpredictable events influence those three criteria either positively or negatively by increasing the budget or schedule (negative outcome) or shortening the duration or increasing the savings (positive outcome). Uncertainties and risks can lead to cost and schedule overruns or even to project failure. The study of Okmen and Oztas shows that there are multiple techniques available and therefore alternatives for decision makers. All these techniques do not have the same particularities; each offers advantages and constraints that may determine its optimal application. The study demonstrates that project characteristics and phases influence how risk-analysis methods should be used. [11][21][23]

4. Conclusion

A result of the study by Knight, Durham and Locke was the positive relationship from manangers and their willingsness to take risks and task performance in gerneral. Additionional Chen and Messner shows that there is a relationship between a successful market entry and the way how to enter the market taking into consideration of the risk-willingness and risk-avoidance by managers when it comes to the point of descion-making. Agarwal and Ramaswami points out that entry modes involve great resource commitments and change of them will cause considerable loss of time and money. Regarding to the different modes, Gupta and Govindarajan found out that risk taking has a significant positive influence on effectiveness of strategy implementation for "build" subsidiaries and a negative influence on "harvest" subsidiaries.

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FACTORS AFFECTING THE FINANCIAL MANAGEMENT OF A COMPANY

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Abstract: *The current strong competitive environment allows healthy functioning only for companies that perfectly control the production, commercial and financial aspects of their business, and at the same time they can perfectly adapt to the changing market situation. We live in turbulent times, the economic environment is constantly changing and there are changes in business. Successful business does not engage in an activity without an analysis of factors affecting its financial management of financial situation.*

Keywords: *financial management, tasks of financial management, financial management factors*

1. Introduction

Financial management of a company ensures the movement of the company's money, assets and capital in order to achieve the basic business goals and profit. Each company has different conditions in its surroundings created for its activities. Impacts of the environment may have positive and negative impacts on business activity.

The role of the company's financial management is to keep track of the factors that impact the company and to create measures to mitigate the negative impacts, but also to embrace the positive opportunities available to the company. The condition for the effective operation of a company is therefore to take sufficient account of all the factors affecting the financial management of the company.

2. The nature of the company financial management

The essence of financial management of a company is to provide profitable activities and other set objectives of the company resulting from financial planning, financial decision-making, and organizing the financial processes of a company. In order to achieve positive results in meeting these objectives, it is needed to take into consideration the level of risk associated with investing funds or financing the company, and sufficiently respect the factor of time and the specific conditions, which the company faces.

"Long experience shows that the condition for effective financial management of companies is to respect a few basic principles. In addition to the golden rule of funding, they are in particular:

- tracking cash flows in a company,
- respecting the time value of money,
- taking account of financial risks,
- deciding on the required rate of return,
- considering the costs of alternative opportunities" [1].

Financial management significantly affects the trading income of the company. Given that profit as a trading income is not the only indicator of the company financial prosperity, it is necessary to pay attention also to other indicators, the source of which is the financial analysis. Even if the company is profitable, other financial indicators can reveal a variety of financial difficulties. Financial management should ensure, under ideal conditions, the balance of all financial indicators of effective business management.

3. Tasks of financial management

The key task of financial management is to ensure the achievement of the company's basic commercial and financial goals. "When implementing this process, financial management must fulfil the following four partial tasks:

- to raise the necessary capital,
- contributing to the efficient allocation and use of capital,
- to allocate financial expenses,
- to record and analyse the course of financial processes" [2].

Getting the necessary capital can be secured from internal or external sources. In the financing process, it is necessary to take into account the financial structure of the company and it is also necessary to know thoroughly the economic surroundings of the company. Contributing to effective allocation and use of capital is conditional on the selection and evaluation of business projects and the effective use of assets acquired through their realization. The acquisition and allocation of capital has an increasingly international dimension. The distribution of financial results responds to the development of external factors affecting the company and its intra-company needs. The distribution of financial results is influenced, for example, by tax obligations, dividend policy, or the possibility of company investing.

Recording and analysing the course of financial processes is provided by separate disciplines such as accounting, statistics, financial-economic analysis, internal audit or

controlling. Without the results of these disciplines, the company's financial management cannot operate.

4. Factors affecting the financial managemnt of a company

Financial management of a company is a very specific activity that must take into account a number of factors that directly or indirectly affect the company and its processes. In order for financial management to ensure that all business objectives are achieved, it is necessary to closely monitor all the factors that influence the financial management and adapt their activities to them.

The main factors affecting the financial management of a company are:

- asset and capital structure,
- cash flow,
- costs, revenues and trading income,
- the position of the company on the market,
- the quality and range of production,
- the quality of the labour force.

4.1 Asset and capital structure

Company assets consist of a set of values that belong to the company and are intended for business activity. The capital of a company represents, on the other hand, the resources from which the assets originated. To ensure that business is effective, it is essential to secure the optimal structure of assets and capital.

Asset is divided in terms of function in the transformation process to non-current assets and current assets. Non-current assets consist of long-term intangible assets, long-term tangible assets and long-term financial assets. Current assets consist of inventories, receivables and short-term financial assets. The asset structure is not an indicator of the success and wealth of a company. It is important to own an optimal amount of assets to enable the company to efficiently use its capacity to support the growth of corporate performance and the achievement of business goals. The capital structure denounces the division of total capital into equity and foreign capital. Equity belongs to the company and the foreign capital is acquired by the lender and is required to pay it at some point in time. Generally applies that foreign capital is cheaper than equity and short-term capital is cheaper than long-term capital. Therefore, it is necessary to take into account the specific interest and tax conditions and to create an optimal ratio of own and foreign sources to ensure effective cover of the company's assets.

4.2 Cash flow

Cash flow represents the difference between the revenue and the expense of the cash in the company. Since both costs/expenses and income/revenue are subject to both material and time discrepancies, the cash flow in the company needs to be monitored. This is the only way to secure the business's ability to pay and finance its business activities. Cash flow information is obtained from a business activity that is the core activity of a company and serves to achieve its business objectives, investment activity primarily involving the purchase or sale of long-term assets or lending and borrowing activities. Also from financial activities leading to changes in the amount and structure of equity and long-term liabilities.

4.3 Costs, revenues and trading income

The primary objective is, in addition to increasing its value, to achieve a trading income that arises if the company's revenues are higher than the costs of the company. Costs are spent on achieving revenues, reflecting production conditions, setting the price of products, and are a key factor affecting financial management. The most important step in the financial management of a company is to keep the costs below the revenues level in order to secure a positive economic result and to insure that the company's assets are not reduced.

Company revenues are all what a company has earned from its business for a certain period. They are indispensable for ensuring the running of a business, and the achievement of business goals depends on their height. The most important revenue for a company is its revenue from the sale of goods or services, which serve as a financing source to cover costs. It is therefore in the interest of a company to maximize revenue, as it reflects to a significant extent the success of a company.

The trading income is the most important indicator of the economy. It represents the difference between the revenues and costs of a company. From the point of view of the calculation, the trading income is divided into the trading income of the economic activity and the trading income from the financial activity. Achieving a positive trading income is a major business goal because it serves to secure the financing of business activities, is an important decision-making criterion as well as an incentive tool. A good financial management of the company should ensure profits.

4.4 Position of the company on the market

Every company is affected by the specific factors around it. These factors directly or indirectly affect the company, and it is forced to adapt them. The environmental impact on the company is very strong and can not be avoided, but the ability of an company to influence the environment is very limited.

The company is closely linked to the marketing microenvironment and the macro-environment. Marketing microenvironment is also called the interaction environment. It is created of such influences that directly affect the company and its functioning. It consist of a company and its customers, suppliers, marketing intermediaries, the public and the competition. The company is therefore an internal marketing environment. Suppliers, marketing intermediaries, customers, competitors and the public make up the external microenvironment of a company. The marketing

environment surrounds and affects the entire microenvironment of a company. It consist of demographic, economic, technological, natural, cultural and political-legal influences that the company can not influence. In order for a business to maintain its position on the market, it must constantly monitor its surroundings, current market conditions and adapt to them. It is also necessary to embrace the opportunities that exist on the market and to minimize the negative environmental impacts on business activities.

4.5 Quality and range of production

The role of the company's management is to decide on the range of manufactured products, purchased goods or provided services. Decisions are affected by number of factors such as demand, production capacity, financial or technological heftiness of products. It is important to make a detailed market research before making the final decision about the product range and offer products that customers are interested in. Within the scope of business activities, it is necessary to adapt to customer requirements and set the planning of its results to these facts. In order for a business to be successful on the market, it must ensure the quality of the products and services offered in accordance with customer requirements and with certain market standards. The quality of products and services and the attractiveness of the range offered must be tailored to financial management, since the success of the sale of products and services depends on the trading income.

4.6 Quality of the labour force

Labour force represents the sum of physical and mental abilities of man to work. With its uniqueness, it can create a significant competitive advantage for the company, but it also on the other hand can lead to a collapse of a company. The success of a company depends on all the important decisions that people make in it. Quality labour force is the most basic and the most important factor for a company, from which all business processes depend.

The quality of the labour force depends on the specific characteristics, skills, abilities and potential of all employees, but is also greatly influenced by the conditions that are created for them. The performance of employees and the quality of their work can support the material security of the workplace, but in particular a pleasant atmosphere and various forms of motivation.

Therefore, a lot of effort and resources must be devoted to developing the employees' potential, educating them and motivating them, because only employees can increase their production of a company by their performance.

5. Conclusion

The natural aspect of a company's transformation process includes all activities related to the providing of inputs to the production, their transformation and subsequent sales of outputs. However, the company's transformation process has, in addition to its natural aspect, a financial side that is influenced by number of factors. Therefore, all these factors need to be monitored, evaluated regularly and take appropriate action. Only in this way will the company achieve its predetermined goals.

Acknowledgements

This article is one of the outputs of the VEGA 1/0870/16 Project.

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CHANGING INTO A RESPONSIBLE CULTURE

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Abstract: *People change their behavior when they are shown a truth that influences their feelings and emotions. This is also the case during organizational changes, where you are dealing with market challenges, cultural transformation and globalization. It is even more puzzling when organizations should deal with global topics such as social challenges, environmental protection, and economic growth. At this level, business is challenged when trying to balance societal needs, business success, and its employee's self-interests. To lead a successful change in business social responsibility, an organization must master the change process and carefully implement all its steps; From identifying the change team, to dealing with corporate culture, implementing the change, and paving the way for the change to become sustainable. There are two levels of change to consider, one is changing individuals attitude towards business social responsibility and the other one is about changing the overall corporate culture. In this paper, we look at both levels; We explore theoretically how persons develop throughout their leadership development to identify the ones that are most suitable to lead the cultural change. Then we elaborate on practical steps that lead to a useful change. And finally, we implement, through a corporate laboratory, a change workshop that targets a large group that represents the culture of the research participating organization.*

Keywords: *Action Research, Change Leaders, Change Workshop, Corporate Responsibility, Learning History, Responsible Culture, Sustainability*

1. Introduction

One of the most challenging topics in medium to large organizations is in implementing change successfully. While some organizations find it easier than others to implement change, only few of them can sustain change over the long term. Research shows that companies that are successful in implementing change have several characteristics in common:

- They know how to overcome "antibodies" the usually reject what is new
- Large scale change usually happens over several steps that include preparation work as well as follow up activates to the change itself
- The main challenge is not in influencing thoughts, but rather influencing feelings

It is even far more complicated when organizations must deal with cultural changes. People in general tend to resist changes that affect their daily activities, they tend to be more pessimistic if the change affects certain behavioral aspects such as decision making or aspects that influence the general corporate responsibility. When this reality is handled well, companies usually succeed in implementing the change. On the other hand, if poorly handles, it causes the whole change efforts to fail and may even have negative impacts on the people and the overall business.

We look in this paper at how are leading organizations able to successfully implement cultural changes. We particularly analyze those changes that connect individuals with corporate social responsibility. The methodology, explained in more details in the following paragraphs, was applied in real life at a medium size company called Wintershall.

Wintershall is a medium size Oil and Gas – Exploration and Production Company with around 2500 employees. The company which is fully owned by a larger group of companies who has taken sustainability as a key topic for business, has decided recently to increase awareness about sustainability in the Oil and Gas domain. Additionally, Wintershall has launched several initiatives to strengthen its corporate responsibility position as well as to change its culture into a more responsible one.

2. Research methodology and learning history

For any research to achieve reliable and valid results there needs to be a systematic way or a distinct system that will 'allow it to be conducted in a rational way (Kumar, 2005). Research in this paper is based on the principles of action research whereby the researcher acts as a change agent inside a business or an organization. This form research involves actively participating in a change situation in an existing organization, whilst concurrently conducting research. Action research can also be conducted by organizations, assisted by a professional researcher, with the aim of improving their processes, practices and strategies.

The concept action research was developed by MIT professor, Kurt Lewin during WWII. In his seminal paper "Action Research and Minority Problems" in 1946, Lewin describes action research as "a comparative research on the conditions and effects of various forms of social action and research leading to social action. The one we base our research one is what is later defined as the "Learning

History". The theoretical foundations of Action Research lie in Gestalt psychology, which stresses that change, can only successfully be achieved by helping individuals to reflect on and gain new insights into the totality of their situations (Lewin, 1946).

2.1 Learning History

A learning history is a form of action research whereby a system or a corporate body captures the learnings and the insights of a group who are innovative and committed to change. Learning history is usually applied to support changes by altering social and environmental factors. The process included the identification and the enlisting of stakeholders can help to develop the desired changed and to transform the organization to make it 'future proof'. This is often referred to as a "Change Object" – and it can be either a change process or a strategy. This means letting a group of stakeholders drawn from a diverse range of backgrounds to work together on some stated goals (Bradbury-Huang, 2015).

Bradbury-Huang describes four steps for applying a learning history in her research. Those steps define learning development steps of the leading group of stakeholders and these are discussed below

- Step 1: The learning history is designed to achieve "Notable Results". Those are moments or periods when a company or an organization has achieved a remarkable social or environmental changes.
- Step 2: A change agent, these are people in the organisation who have the knowledge and the commitment to change an organization. They will question the organization and make ask important questions such as what were the drives behind the change? They will try and enlist the views of the stakeholders.
- Step 3: Compiling the findings and writing up a case study about the important changes of the organization. This needs to be documented and often it is recommended that it is done in a way that can be easily documented such as video.
- Step 4: Validation of results by discussing the changes and their impact on stakeholders. This is where the changes or the "history" of change are presented. Stakeholders have the chance to clarify activities and define what is needed to make more changes in the future (Bradbury-Huang, 2010).

2.2 Results of a Learning History Project

Measuring the impact of any learning history project is important to provide the stakeholders with guidance and an understanding of their input and this in turn promotes the change. In common with other change tools, a learning history is most effective when shared a 'community' of shareholders– ideally with the whole organization. The sense of incompleteness and needing to do more can lead to a feeling of failure and discourages many stakeholders and this is bad for a change. It is important to gather realistic expectations of goals of learning history. The outsider "action researcher" should share their research with the wider community, thus enabling a larger group of stakeholders to benefit from the learnings that are collected through the project.

In order to make sure that an action research project is a true Learning History project. It is recommended that there is a case study approach and that there is extensive data produced from a range of perspective. This will allow a group to really learn about change and what can facilitate change in an organization. Change management is also very important if action research is to be successful. Planned change is a term first coined by Kurt Lewin to "distinguish change that was consciously embarked upon and planned by an organization, as averse to types of change that might come about by accident, by impulse or that might be forced on an organisation". However, just as the practice of change management is dependent on a number of factors, The action research may need to select an appropriate model of change management (Bradbury-Huang, 2010).

3. Learning history with Wintershall

Action research was conducted by Wintershall which has been recognized as successfully implementing decisive steps measures to transform itself into a more responsible business. Wintershall is a mid-size Oil and Gas Exploration and Production Company that has 3000 staff approximately. The company is a subsidiary of BASF (as seen in the above case study), a conglomerate of companies that have recognized their social responsibility duties. They are now all committed to sustainable business models and ones that seek not to harm society and the environment but to contribute to their improvement and especially about sustainability.

The company established a team to supervise the changes and they were the designated change leaders. The members of the team have all different specialties and they are expected to implement changes in their respective field. This required the team to adopt a culture of sustainability and improving responsible dictions making in the organization. This required that the team adopted sustainability as their main goal and priority and to align these with the other goals of the company.

The researcher, who acting as a change agent, helped to plan and execute one of those change projects within the "Field Development" division of Wintershall. Such an approach is promoted by Actin research. Conducting research can at the same time lead to meaningful changes. The change execution project was divided, using the principals of a learning history. The process was divided into the four main phases:

- Analyzing the history of sustainable behavior of BASF (the mother company of A). Relating thee to the company.
- Presenting the major features of the firm in the form of "Notable Results";

- Writing about the results in ways that show and promote the need for change
- Administering the change workshop and ensuring that it is an environment where all the stakeholders can contribute.

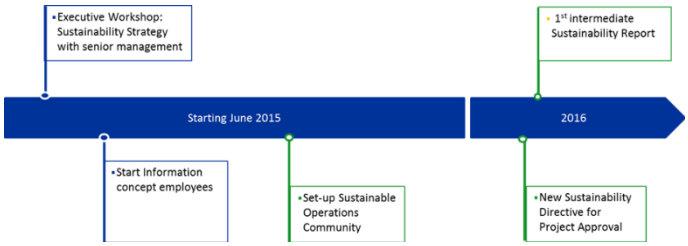

Figure 1 Wintershall's Sustainability Journey - Source: Company

3.1 Executing the Change

The staff in the "Field Development" division of Wintershall, up to an including to the level of department heads and the vice president heading the division, were invited to the change workshop. The workshop was called "How to Drive Responsible Decision Making in Field Development Projects?". The aim of the workshop was to facilitate change and to identify how to overcome the barriers to change.

The "Field Development" division involved all aspects of an organization and included the exploration and production fields, those were an expertise in the following areas were also involved, Geology, Geophysics, Reservoir Engineering, and Drilling. Those experts had to fulfil the role of "Stewardship" in field development projects. The steward is the guardian of the and the goals and is an advisor to the project manager. Their role is not to directly execute the project, the steward should champion change and give advice to the company's management. The steward should actively seek to challenge project reviews – a step which is fundamentally important in field development decision making. This can ensure that the changes are being made and that the project does not become merely a paper exercise.

3.2 Presenting the History of Responsible Behavior

To conclude the first step, there needs to be drawn up a documenting history of responsible behavior of the mother company of A. This was presented to the audience of the change workshop in a persuasive way that helped them not only to understand the issues but to be motivated to implement change. (BASF) has long record of social responsibility and has historically implemented a policy that promotes sustainability. It was significant that before exploring the details of change implementation, it is important to raise the audience's awareness on social responsibility about the parent mother company and how important it is to Wintershall's stakeholders.
The figure below presents the key "Notable Results" of BASF:

Figure 2 BASF's Notable Results

2014 has witnessed a whole new approach for sustainability transformation and this is the "Triple S" initiative. This initiative, allows the company to develop a sustainability assessment on its products. This is then classified into four groups based on their suitability behavior. The outcome of this initiative resulted in a series of sustainability goals for all the subsidiary companies and consequently affecting the business targets of Wintershall.

3.3 Workshop

Step1: Split into two groups A&B

Group A (Processes and Systems): To embed sustainability decisions into processes and procedures at all levels.

Group B (Human Factors): To determine if Stewardship in steering / influencing the project towards sustainable solutions.

Step 2: Discussion and Group Results

Each group would sit together to discuss the results and select what would be important for this group of Stakeholders and ultimately, what is going to be important for Wintershall. The group then presented the findings and then prepare a presentation on a Power Point Slide or Physically on a Flipchart, to demonstrate the results.

Step 3: Whole Audience Discussion and Actionable Points

At this stage, the two groups offer their recommendations to the whole audience.

The assembled Stakeholders, at this stage, discusses and identifies the two most actionable topics that resulted from the workings of the workshop

Way Forward: The best idea is selected, and it is expected to be implemented within the next 3 months either as a pilot project or as a corporate directive or order.

Brainstorming is a recognized way of getting great ideas. These can help to propose new solutions. One of the advantages of the Brainstorming method is that it facilitates creative solutions and encourages collaboration. During the brainstorming session, there was an intense discussion of different ideas and to come up with one telling idea that needs to be implemented soon.

3.4 Workshop Results

Group A (Processes and Systems): Solutions for embedding sustainability decisions into processes and procedures:

- Implement sustainability into existing corporate processes (for example, Projects Approval Guidelines)

- Avoid shortcuts and short-term solutions that only make processes appear sustainable (e.g. hiring contractors to bypass labor working time)
- The development of sustainability KPI's that need to support decision making

Group B (Human Factors): Examined the role of Stewardship in steering and influencing the project towards targets that are sustainable solutions and delivered a series of suggestions:

- Applying responsible decisions as early as possible in the lifespan of the project. At this stage, the concepts for field development are being assessed
- Introducing Lifecycle views on projects (such as proposals for recycling and the reusing of material)
- Sustainability Framing workshops. These are designed to assemble all project stakeholders to converse on sustainability factors into the project
- After discussions and 'brainstorming', this group of stakeholders agreed to the third action plan

Because of this workshop, the group of stakeholders have developed actions that can be implemented and assigned to suitable action owners. These can be assigned to different change agents as part of a project for change.

4. Conclusion

Successful organizations are those who can effectively manage change. It is important a company can change in the very competitive globalized market. It does not matter if there is small process change (micro level) or large organizational change (macro level), or even a cultural change. A company needs to be able to master change at all levels. This is particularly the case about changes in sustainability, which is becoming a major preoccupation of the business sector and of governments.

Change needs leadership. Not all change leaders are at the same level leadership development. A new and modern form of leadership is best to effect changes in an organization. Only those who are have the abilities of a transformative leader who take a creative and democratic approach towards the business, can facilitate cultural change. Those leaders who view the success of the business from the perspective of the environment and society can cause a business to be a true sustainable enterprise.

Companies must employ best practices such as the ones presented in this learning- history-project to integrate sustainability into the decision-making process at all levels of management. To implement changes, the business should designate transformative leaders and to use their leadership skills and ability to inspire individuals. This can greatly facilitate change. It is very important that a person who is a transformative leader is sincere and believes wholeheartedly in the aims of sustainability. They also need to be able to share their views with others and to persuade others to become change agents in the process of transforming an organization into a sustainable organization.

This kind of change will become self-sustainable since it starts from the society, facilitated by the business, and is lived by the company' s stakeholders – the company employees.

Acknowledgements

I would like to express my sincere gratitude to Dr. Falk Ahnert for his support of my PhD study and related research, for his patience, motivation, and immense knowledge.

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Session: Economy, Financing, Public Administration

Index of Author(s)

INSTITUTIONAL CONDITIONS OF LOCAL DEVELOPMENT IN POLAND - SELECTED ASPECTS

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Summary: Based on the literature of the subject, the work presents the influence of local government units on local maintenance and development. Local government with well-organized support institutions can effectively influence the creation of business activities and strengthen the competitiveness of existing companies, thus contributing to the activation of local development.

Keywords: *local development, community, economy, local government*

1. Introduction

Local government is one of the oldest forms of self-government. According to Art. Article 163 of the Constitution of the Republic of Poland local government "performs public tasks not reserved by the Constitution or by law for the organs of other public authorities". [1]

The essence of local self-government constituting a manifestation of the principle of decentralization of administration in a state is the autonomy of self-management by the local community (commune, county, voivodship). At the same time, these units of local government have legal personality, and they have the right to own property and other property rights. Local government is therefore independent of government administration. It is subject only to limited central government intervention: self-government supervision is exercised by the prime minister and voivodship, and in the area of financial affairs - regional accounting chambers. Local government operates within the limits of the state and in accordance with applicable law. [6] The constitution defines self-government as: "a community of people who are lawful and which encompass all inhabitants of a territorial unit."[1]

Clarification of the role of institutional factors in local development has significance beyond purely scientific inquiry, for it can provide the practical knowledge needed to manage local development. The impact of these factors is difficult to determine because the "attribution" of specific phenomena that contribute to local development in the category of cause and effect of selected institutional factors is not easy. "Thus, the most important stimuli of interest in current scientific concepts of local (regional) development should be distinguished from the broad spectrum of impacts.[8]

It seems that such a clear institutional impulse decisive for local development is the interaction of local authorities with enterprises within network structures and the quality of social capital.

2. Civil society and local development

Open society, as an idea, has become the hypothetical community of all people who are bound by the bonds of brotherhood and universal values. It is a vision, shared by individuals and communities, interacting around. Progress is a result of the humanization of interpersonal relationships and the universalization of concepts.

Subjectively assessed freedom of the individual, his independence, and his consciousness and will, may direct the community towards new forms of existence. The dynamics grows even more as the population grows. [6] It is understood that civil society is a network of different types of interconnections between individuals. This concept assumes human activity in many different fields, e.g. economic, social or political. Citizens are acting on the public stage as individuals or collectives, and not as tools for managing the state. Of particular importance is the existence of effective mechanisms to ensure social balance and the creation of civic and democratic relationships. By means of social equilibrium, we understand legal regulations, institutions and organizations that aim to combine the interests of different segments of society. Their lack of recognition is one of the problems of the current state reconstruction. The ineffectiveness of these mechanisms is related to dysfunctions caused by transformation processes and to the concentration of management by representatives without public participation. It is noted that in the eastern part of Europe, civil society has taken over many of its prerogatives from the governmental administration through institutions such as local governments or non-governmental organizations. third sector. [4]

Power, as a decisive factor in the general affairs, i.e. national and local, as belonging solely to the nation and the authority formed in accord with its will, the shape of the administration, consisting in the exercise of the powers vested in the will of the people, undergoing social control. Open society is not the majority government, as it protects the rights of minorities. In such society a power exercised through the administration, i.e. the powers conferred on the officials, is subject to social control. The ideal of an

open society becomes a process. May cause danger. By choosing it, people may lose their sense of security as to their social status. At the top of the hierarchy, they may naturally be afraid of openness and competition. For others, it may be too difficult to develop the concept that people impose on the person, such as trying to become an active person, refusing to meet certain needs, controlling oneself, and accepting responsibility.[4]

Democracy and market economy are the basic foundations of an open society, as well as a mechanism regulating markets, especially financial ones. Rationality and moral code are considered basic basics. They are reflected in other cultures. [3] For example, Confucian ethics, based on family and relationships of interpersonal relationships. The Western form of democracy does not have to be the only form suitable for an open society. Open society should be pluralistic, but it should not be directed towards pluralism in order to lose the ability to distinguish between good and evil. It was also acknowledged that tolerance and moderation may have their extremes.

Collective decisions cannot be made solely on the basis of rational orders. Laws are needed, inter alia because without existing norms in the relationship between individuals and individuals, individuals and groups and groups and groups, discretion could lead to aggressive destruction, as is known from history. It needs institutions that recognize their imperfections and create mechanisms to correct errors according to the will of society. Global open society cannot be formed without human consent to its basic principles. Open society, in order to achieve the advantage of its favorable opinions, through self-governance.[5]

3. Local development in Poland and the activity of self-governments

Regional development is a process in which structured forms of efficient use of natural, material and human resources are essential in order to ensure the continued prosperity of the population living in the territory. In order to achieve the strategic objectives of the region, all its development factors should be correlated in the management process. This process may also be targeted at the priorities identified in the regional development strategy, which in the EU hierarchy occupies second place after the budgetary policy. Efficiently facilitating the implementation of contemporary socio-economic challenges was the theoretical development of the basis of regional development. These challenges arise "from the need to create a common territorial, organizational and institutional system in common with the European structures in the field of regional policy".[10]

Local developments are influenced by various factors that are not constantly changing, and therefore should be continually and continuously analyzed. Key factors influencing local development or limiting it include:

- external and internal factors (external influences from relationships with the external environment - national or international - internal resources, management skills, local government activity, business climate),
- macroeconomic and microeconomic factors (such as those that are not dependent on local actors and are shaped at national or international level e.g. tax rates or free trade agreements; microeconomic factors are those affected by local authorities);
- spatial factors (regional or local variations) and spatial variations (the same across the country),
- hard and soft factors (hard factors such as access to infrastructure, location and connection to external networks of energy and heating infrastructure services (energy, gas, heating, renewable energy), industry structure, size and type of ownership The soft factors are those that are difficult to measure, such as creativity and innovation.).[8]

For the local development are primarily responsible entities operating in the local community and operating on the local market. The main entities responsible for local development are local authorities (municipalities, counties and regions).It is precisely from the willingness and ability of local authorities that a municipality or other administrative unit will develop. It is known that the more developed community is more attractive to the local community as well as to tourists or external investors. By law, local governments carry out both own and contracted tasks. Own tasks include, for example, spatial and ecological order (e.g. spatial planning, environmental protection, natural disasters), social infrastructure (e.g. education, health care, social care, cultural institutions), technical infrastructure (e.g. roads, bridges, water supply, public transport), security and public order (e.g. fire protection, sanitary safety, communal guards). On the other hand, commissioned tasks concern: running a civil registry office, agricultural census, organizing parliamentary elections and other. [7]

More recently, local economic development concepts have emerged, departing from the paradigm of neo-liberal economics, and leaning towards an institutional approach that takes into account not only what is traditionally called economic factors but also institutions and attitudes, and the impact of low living standards for productivity and development. Local development in the economic sphere is based on both internal (endogenous) and external (exogenous) factors, or can be based on centrifugal premises. In the case of endogenous factors, the basis of development is local resources of basic production factors and available human and intellectual capital. On the other hand, the exogenous factors of development are the localization of new manufacturing plants belonging to external entrepreneurs. They influence changes in the structure of local production. The centric premises of economic development result from the reaction to external changes (technological and organizational) and the result is the creation of new companies or the development of existing ones. The impulse to stimulate entrepreneurial

attitudes is cooperation and joint actions of existing companies. Creation of local development forces local authorities to influence the appropriate combination of endo- and exogenous factors. [2]

Establishing institutions and stimulating mechanisms to support entrepreneurship allows us to create, adapt and implement new solutions that are closely related to increasing the competitiveness of companies and their success on the market. Developing a business development model is not an easy task. In every industry or region, businesses are subject to different conditions, resulting from differences in GDP levels, labor productivity, unemployment rates, and access to infrastructure, and levels of human, social and intellectual capital.

This creates the need for an individual approach to working and emerging companies. Nevertheless, local authorities should be guided by certain general principles when creating business conditions. These include:

- development and implementation of strategic plans based on the vision of the future of enterprises,
- implementation of instruments and mechanisms influencing quality improvement,
- the need to stimulate innovation and creativity in enterprises,
- stimulating organizational learning,
- development of employees, their training, motivation and creation of a strong, coherent organizational culture,
- incorporating ecological aspects. [9]

The creation of favorable conditions by local authorities for the development of entrepreneurial and innovative activity of local companies can contribute to the overall socio-economic development of the region. The plane of permanent partnership with local governments can create regional innovation systems that create a network of cooperating manufacturing, service and public, financial, social and scientific organizations. Institutional linkages within regional innovation systems are based on the premise that strong linkages between local communities, which own business, openness to the world, and cooperation with the institutional environment will stimulate and diffuse innovation and thus increase the competitiveness of the region. [2]

4. Factors of development and competitiveness of regions

Competitiveness is seen as a key success factor in economic policy, hence competitiveness factors include:

- reducing the technological gap as measured by the increase in the number and use of patents that directly affect innovation,
- the growth of foreign direct investment, introducing new products, technologies and indirectly forcing the raising of the skills of the workforce;
- reducing disproportions in human capital including education, health and social care; improving the situation in this area raises the activity and involvement of the population in improving living conditions,
- the expansion of business environment institutions, creating an effective network of companies supporting entrepreneurship and technology transfer,
- the ability to use the Structural Funds of the European Union as a stimulus and an opportunity for all participants involved in regional development.[12]

Regional development factors can be divided into traditional and effective. Traditional development factors include natural conditions and resources, existing investment in regions, and labor resources of the region. They are the basis for extensive, effort-intensive development, anchored in the growing involvement of individual resources. Among the factors of effective regional development is the intangible infrastructure, which defines, among other things, the quality of human capital. They create it: the level of knowledge, education, experience, qualifications, entrepreneurship, resource-fulness, the rule of law, human attitudes, traditions, sense of identity and regional identity. Other effective factors for regional development are: quality of property resources, economic structure of the region, spatial development of the region13.Efficiency (qualitative) factors have become increasingly important in recent years due to the possibility of gaining competitive advantage on the basis of elements difficult to copy. The above considerations concerning the ways and possibilities of economic development, by creating competitive regions, determine the quality of human capital as a feature of human capital, enabling the creation of a lasting competitive advantage in the studied region (region, country). [12]

5. Summary

Theoretical concepts, as well as empirical research, confirm that the potential resources of local governments in the form of decision power, knowledge, financial resources and regional development tools can stimulate local development. In the structure of governmental and governmental administration, separate workstations coordinating activities for the development of entrepreneurship or innovation development centers should be created, creating together with other institutions of the business environment and scientific and research units and universities cooperation networks. Their aim should be, in addition to coordinating actions, to provide administrative, legal, financial, tax, marketing, etc. Among the most important initiatives of enterprise support agencies are the creation of funds to facilitate access to credit by entrepreneurs through the provision of sureties and loan guarantees. The essence of the proposed, active attitude of local authorities, involved in creating conditions conducive to local development, cannot be top-down controlled, as this would be contrary to the idea of market-pricing mechanism of resource allocation. In this case, efforts should be made to build an understanding between

all key parties, which will contribute to the bottom-up shaping of entrepreneurial attitudes. Effective help from local authorities in activating entrepreneurship can contribute to the region's economic development, and expenditure from the budgets of the inspected offices to support economic initiatives will be reimbursed in the form of local taxes paid by well-functioning local business entities.

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THEORETICAL ANALYSIS OF RISKS ASSOCIATED WITH ECONOMIC ACTIVITIES

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Abstract: *The article deals with the risks associated with business operations. Thus, the general purpose of the considerations is to analyze, characterize and identify the most important risks in this area. The work is purely theoretical. Due to the transparency of the reception, it was decided to divide the subject into three parts combined into a logical whole. First, the introduction to the subject was presented, then the second part was devoted to discuss the risk in business, so the focus was on: definitions and risk sharing, as well as characteristics of potential risks occurring in the case of running a business. The whole was crowned with a lapidary summary.*

Keywords: *business, risk, insurance*

1. Introduction

The concept of risk is a basic element for insurance. It is the existence of risk that is an incentive to search for the best forms of security. The nature of risk determines both the development and the specialization of insurance. The activity of insurance companies is related to the identification and division of risk, their quantification, as well as its monitoring. The above-mentioned problems are important from the perspective of the insurance company and the insurance entity. From the point of view of the companies, they concern making decisions, among others, about the acceptance of risk, the amount of the insurance premium, the financial policy that is needed to ensure the receivables and the profitability of doing business. From the point of view of the insurers, it is about providing the best possible insurance coverage [7].

2. Risk in business - theoretical approach

2.1 Definitions of risk

There are many different definitions of risk in the subject literature. The concept of risk is not easy to understand, because it combines a lot of controversy both in the attempt to determine it and the measurement itself. In the Polish language dictionary the risk is defined as follows: "a project which outcome is unknown, uncertain or problematic. In colloquial language means a threat of failure, blunder" [11].

The risk does not have a uniform definition and therefore it is not possible to formulate an unambiguous as well as a universal definition. The first attempt to define the word "risk" was taken by A.H. Willet, who claimed that the risk is: "objectified uncertainty of an undesirable event, which is perceived as a negative deviation of the achieved target value from the level previously planned" [1]. He also drew attention to the fact that the risk changes with the level of uncertainty, and not with the degree of probability.

In earlier years, the risk was attempted to be defined by means of various sciences and theories, including primarily in the fields of economics, behavioral sciences, legal sciences, psychology, probability theory [9]. In the circle of economists from around the world, the view was spread that risk is the quantifiable uncertainty of negative deviations from the intended effects. This concept is the starting point for the majority of risk theories set against the background of the company's operation. One can approach the issue of risk in two ways [8]:

1. the approach characteristic of economic thought,
2. the approach specific to insurance law.

In the first approach, the risk is primarily captured from the point of view of certain dangers, which are perceived as the cause of real events or facts of specific economic and social phenomena. The occurrence of each of these events proves that the risk is considered to be a set of all causes connected with each other, and thus as a kind of abstract construction.

In an approach that is characteristic of insurance law, risk is defined as an event resulting from the occurrence of various dangers. It is the reversal of the first approach and captures the risk not from the effects side, but from the side of the results, and the events causing the primary state changes are referred to as random events.

In literature, which deals with risk management in insurance, the risk is usually defined as the possibility of incurring a loss or damage. This type of definition assumes limiting the content of the concept of risk only to a negative, unfavorable result, i.e. a loss or achieving benefits smaller than those assumed.

Summing up, it can be concluded that the multiplicity and diversity of risk definitions results mainly from the needs of the practice. Different definitions talk of a certain state, but they do not uniquely identify this concept. In the literature of the subject there is a conviction that the risk in the conditions of a market economy is an objective and universal phenomenon, one that affects its each domain in

a different way. All this boils down to the fact that at the present time running a business regardless of its subject, as well as the scope in any case, should be based on conscious risk-taking and effective management of it.

2.2 Risk distribution

The complex nature of risk causes, that the problem of creating a general definition is solved by its classification, which shows its various aspects. The basic goal of systematics is the understanding of the nature of risk itself, but it also provides the basis for the classification of this concept in the management process, as well as the methods of assessment, undertaking and insurance options.

The classification is determined by the adopted criteria, but in the context of insurance one can observe in the literature of the subject more consequences and determination than in relation to the problem of determining the essence of risk [7]. I. Kwiecien, in his book, classifies the risk as follows [7]: objective and subjective risk; pure and speculative risk; fundamental and particular risk; static and dynamic risk; natural and social risk; financial and non-financial risk; personal and property risk.

The distinction between objective and subjective risk [10] is associated with combining risk and uncertainty. The criterion for division is to be objectivity, on the one hand, and measurability on the other. The subjective risk, also known as the risk of uncertainty, reflects situations in which the sense of threat comes from a unitary assessment of reality. This means, therefore, a subjective belief about the existence or non-existence of the risk.

The existence and size of uncertainty depends primarily on personality traits. However, there will not be two identical people who will show identical willingness to take risks. Individual factors, such as gender, age may influence individual propensity to risk. The distinction of subjective risk and consideration of all psychological factors is of great value in relation to decisions and assessments undertaken in the risk management process.

Uncertainty is only a subjective belief about the existence and magnitude of risk, which in itself can be an objective so measurable category. That is, it exists regardless of whether it was recognized by the individual. The main condition for the emergence of risk is that the probability of an event related to it is greater than 0 and less than 1. This event must be a possible event, but it can not be certain, because in this case the risk will not exist.

Pure and speculative risk [10] has been specified due to the possibility of risk consequences. The realization of pure risk always has negative effects. Thus, only a negative result (loss) or a neutral result (no loss) can occur. The following risk types can be distinguished [7]:

a) the risk of reduction (loss) of assets due to natural forces, theft or misappropriation, confiscation by the authorities,
b) the risk of liability for damage caused to third parties, e.g. consumers, suppliers, it is the risk in which an obligation to repair these damages arises,
c) personal risk related to accidents at work and the risk of death, illness, disability of employees or members of their families, if the company has committed to provide in such cases.

Speculative risk can be defined as a situation in which both losses and profits are possible. The implementation of this risk can bring both negative (loss), positive effects (profit) and may not bring any changes.

The third division of risk into fundamental and particular risk [7] was created using the criterion of the source and a scope of the risk impact. The fundamental risk is influenced by factors such as: economic, social, political or natural forces. The effects of realization of this type of risk affect the entire economy (society) or many groups of entities. Losses that may arise from fundamental risk are of mass character and have a large overall value. An example can be high inflation level, unemployment, war or floods.

Particular risk has a more individual character regarding events and vulnerable entities. An example of this type of risk can be considered as theft, arson or injury due to an accident. As a result of the implementation of the particular risk, its effects affect a specific individual, and not as in the case of the fundamental risk the whole society.

The different nature of these risks also determines a different way of controlling and managing the risk. The fundamental risk should be primarily in interests of the state, which prepares an appropriate system of reaction, prevention and undertaking of potential losses. On the other hand, the particular risk should be of interest to the exposed individual. However, in both cases, one of the management methods may be insurance. In the case of fundamental risk, there are many limitations and difficulties, sometimes even the need to create a support system (subsidies), as well as a guarantee for private insurers or organization of state insurance systems.

Another risk group presented by I. Kwiecien is the static and dynamic risk [7]. This division was created due to the passage of time and civilization factors. Static risk is defined as a risk that is not dependent on social and economic changes. This is mainly about the operation of nature forces, but also death and theft. Realizing this kind of risk brings losses and we can not talk about the source of profit here. This risk can be predicted and occurs relatively regularly.

Dynamic risk is dependent on social and economic changes. Advanced technologies, organizations, tastes and preferences of customers, employee specializations and

lifestyle changes also have an impact on these changes. This risk is directly related to the progress of civilization and the man's desire to make profits.

The division into natural and social risk [7] was made on the basis of the risk source criterion. Natural risk is created by nature itself and phenomena occurring in it that pose a threat and the possibility of loss.

The source of social risk is primarily the behavior of individuals or entire human communities. It may be related to, among others, actions taken or omission, e.g. murder, theft may be an effect that accompanies, secondary to specific activities, e.g. running a business or driving a car.

Financial and non-financial risk [5] was created due to the nature of losses related to its implementation. On the one hand, the implementation of some risk categories does not always generate losses (e.g. an event in the form of a child's birth, in this case there can be no loss and/or profit, as well as an increase in needs), whereas if a loss arises, each of its characters has a financial value. Sometimes this value is difficult, and sometimes even impossible to estimate and express in money (e.g. the risk of losing death).

The last division, which include the personal and property risks [7], arose using the criterion of goods that the risk implementation concerns. Personal risk applies to human being and basic personal goods, such as life, health and work ability. Some authors also include unemployment in this type of risk [5]. The above-mentioned categories are, however, difficult to measure, and as a result of this risk realization, a loss or a financial need may arise. A characteristic category in the field of personal risk are all non-proprietary personal goods that are related to the psychophysical sphere of a given person. It is, among others, about bodily integrity, surname, or image. The risk of violation of these goods can also be classified as personal risk, because they have a close relationship with the person and inalienability.

Property risk is a risk that relates to the property situation and, as a result, may result in a decrease in the value of assets or an increase in the liabilities of the entity (arising of liabilities).

From the above-mentioned all types of risk, the most important for the process of managing it, evaluation and qualification for insurance are [7]: objective and subjective risk; pure and speculative risk; fundamental and particular risk.

The division of risks in insurance has three basic tasks, namely [4]:

1. selecting all the risks that are suitable for insurance,
2. enabling reasonable decisions making regarding the acceptance and valuation of risks for insurance,
3. well-defined risk that is covered by insurance (in the case of valuation of due damages).

The risk that may be the subject to insurance should primarily [3]:

- be unambiguously defined and distinguished,
- be characterized by the independence of events from the insuring party, the insured or the beneficiary, the point is that none of the listed persons can have a deliberate influence on the appearance or the result of the event,
- be sufficiently stably conditioned, because if the frequency of occurrence of a given risk changed too rapidly, then its occurrence and the extent of the consequences in the future could not be predicted well enough,
- have the economic nature of the effects of events, it means that the value exposed to the risk must be economic and be expressed in money,
- be measurable, because if you can not measure risk, you can not use advanced insurance techniques,
- be a pure profit, i.e. due to the insurance techniques used, only the so-called pure risk, in which there is only the possibility of loss or damage, can be covered by insurance.

2.3 Characteristics of risk related to business activity

The risk accompanies the man for ages and is associated with every action they undertake, as well as it exists independently of themselves. To this day, independent (static) risk has not changed its form [7]. This is due to the fact that today there are natural disasters, arson, theft or death of people. However, on the one hand, the society, enriching itself, and thus possessing more and more material goods, may cause an increase in the value of losses resulting from the implementation of risk. On the other hand, the rapid development of collaterals, e.g. alarms, reduces mainly the frequency of risk materialization and may affect the amount of losses incurred.

When talking about the risk related to business activity, it is necessary to pay attention primarily to the interests of the entrepreneur and the specificity and environment of the particular business. This risk depends to a large extent on the type, objectives of the undertaking, the hierarchy of values in the enterprise, or also on the internal structure. In the literature on the subject, many different classifications of risks associated with economic activity can be found. As the most important from a practical point of view, the following sharing can be indicated [7]:

1. financial and non-financial risk - due to the specificity and, consequently, possible approach in the risk management process, the ability to apply specific instruments,
2. global risk and organization risk - also referred to as external and internal, the division criterion is the

location of the source of the threat and, consequently, the scope of the entity's impact on the risk.

Financial risk for an enterprise can be defined as having its source in events on the financial market and related to financial flows, and it can include market risk, credit risk and liquidity risk [5]. Non-financial risk includes other types of risk, i.e. operational, model, settlements, regulations (legal, tax, accounting) as well as political.

The division of business risk into financial and non-financial risk is useful in the context of selecting risk management methods. A characteristic feature of financial risk is its measurability and the possibility of the direct capturing its impact on the financial result. Non-financial risk is characterized by the difficulty of the direct capturing and measuring its impact on the profit realized by the entity [2].

The global risk and organization focus mainly on the functioning of the economic entity as an organization and as a participant of the market operating in a specific environment. This risk classification takes into account the company's specification and its sensitivity to external factors [6].

Due to the specificity of contemporary business rules, we can also present the following risk classification of enterprises [7]:

1. a generic criterion:
a) market risk - the natural consequence of the presence of an economic entity on the market and its contacts with other entities may be related to the interest rate, the exchange rate, the price of goods, instruments and services as well as stock prices,
b) operational risk - is related to the operational activity of the company, so with daily functioning aimed at achieving the company's objectives,
c) legal risk - it concerns the risk of legal regulations changing in the area relating to the company's operations (tax and license regulations),
d) credit risk - is connected with the possibility of counterparty's failure to perform contractual obligations (counterparty default risk),
e) reputation risk - is associated with the company's image in the eyes of clients,

2. the criterion of the source of danger and the degree of dependence:
a) internal risk (organization) - the structure depends on the type and form of business, it can be controlled by the company,
b) external (global) risk - the company has no impact on that type of risk,

3. criterion of risk areas:
a) property risk - it may directly occur in the form of asset depletion, a decrease in the value of assets or an increase in liabilities or, indirectly, in the form of loss of expected benefits, including profit.
b) liability risk - is associated with the possibility of a loss for a company that, among others, does not comply with the relevant laws and regulations concerning the conducted activity, or caused damage to a third party or is obliged to repair it (civil liability),
c) the risk related to human resources - results from mistakes, lack of competence, absenteeism, conscious action, health and safety at work as well as claims for damages.

3. Conclusions

The insurance classification of risks and their definition is primarily aimed at protecting insurers against unpredictable liabilities. However, it also protects the insured themselves, for whom the insurer's insolvency is the decisive and greatest risk after the insurance agreement is concluded.

Summing up, it should be stated that regardless of the fact of risk realization, its dynamic nature in business operations (which is caused by the changeability of the company's environment, as well as the company's pursuit to continuous development and innovation), enforces constant risk monitoring. Identification of the risk, which should be a continuous process, is necessary to assess the correctness and functioning of the insurance program, as possible modifications require changes to the terms of the contract.

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EMPIRICAL ASSESSMENT OF TAX MULTIPLIER IN FOUR DIFFERENT PERIODS IN THE U.S. HISTORY

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Abstract: *A circular flow model of GDP and an empirical equation are developed to estimate the contribution of various percentage change of expenditure to the percentage change of GDP. Also, the various marginal propensity of expenditures and the expenditure and tax multipliers are calculated to get a quantitative evaluation of the importance of various expenditure to GDP. In the meantime, the longtime economic data are separated into four different periods: 1929-1950, 1950-1970, 1970-1990, and 1990-2017, so as to better capture the economic characteristics in different periods. The results suggest that the household consumption and the government expenditure dominate the percentage change of GDP while MPC (marginal propensity to consume) shows an increasing trend with years and MPG (marginal propensity to government expenditure) shows a decreasing trend with years. Being influenced by MPC, the absolute values of the simplest form of expenditure multiplier (EM) and the simplest form of tax multiplier (TM) show an increasing trend with years. However, when all expenditures are considered, the absolute values of the sophisticated form of EM and TM show a decreasing trend with years due to the influence of the government expenditure and others. In specific, the influence of the government tax policy on the economy is strengthening with years, but, when the government expenditure and others are considered, the influence becomes weakened. This finding suggests that the recent Trump tax reform is a right route toward stimulating the current economy although the economic response may not be as strong as the past Reagan tax reform.*

Keywords: *Expenditure and tax multiplier, marginal propensity of expenditures, empirical assessment, longtime trend*

1. Introduction

The change of the gross domestic product (GDP) is a good indicator of the fluctuation embedded in the economy, and expenditures including consumption, investment, government expenditure, export, and import determine the value of GDP while capital and labor are the key drivers of the economy [1]. Hence, checking the effect of the percentage change of expenditure on the percentage GDP change would be a useful means to capture the key influential factor to the economy and to develop a suitable corresponding policy. For such purpose, marginal propensity to consume, save, and invest have been defined. In addition, expenditure multiplier and tax multiplier are defined to measure the change in GDP triggered by change in expenditure and tax revenue, respectively.

From the longtime perspective, economic variations fluctuate up and down frequently. The federal government would implement various policies accordingly. Each policy may prevail for a short period of time and then it may be offset by another policy in a long time. In this paper, the past economic data are divided into four different periods: 1929-1950, 1950-1970, 1970-1990, and 1990-2017. The purpose is to study the longtime variation of the effect of the percentage change of expenditure on the percentage GDP change and to understand the general longtime variation trend.

In this paper, empirical approaches have been developed to evaluate the contribution of the percentage change of various expenditures on the percentage GDP change, and to estimate various marginal propensity of expenditures and the expenditure and tax multipliers in the above-stated four different time periods so as to compare and understand the effectiveness of government spending and tax policies on the economic growth during different periods.

2. Circular Flow Model of GDP

To structurize the flow of economy, the circular flow model of GDP is adopted. Flows of goods, services, labor, and capital to and from various sectors in the economy can be shown as in Figure 1. In the figure, products flow clockwise while money flows counter clockwise. The factors of production includes labor, land, raw materials, etc. GDP (Gross Domestic Product) is estimated by the final sales (or expenditure) method [1] and is the summation of consumption (C), investment (I), government expenditure (G), and net export (NX) which is the difference between export (X) and import (IM). Hence,

$$\begin{aligned} \text{GDP} &= \text{Y} = \text{Aggregate Demand} \\ &= \text{Consumption} + \text{Investment} + \text{Government Expenditure} + \text{Export} - \text{Import} \\ &= \text{C} + \text{I} + \text{G} + \text{X} - \text{IM} \\ &= \text{C} + \text{I} + \text{G} + \text{NX} \end{aligned} \quad (1)$$

In the meantime, the corporate tax (CT) and the personal tax (PT) influence the government receipt and the government deficit. The influence can be minimized if the government controls its spending carefully. In the figure, the tax rate, interest rate, inflation rate, and foreign exchange rate are influential factors to the flows of products and capital. To households, the disposal income (Y_{dis}) is equal to per capita wage income (W) multiplied by the employed labor (L) minus the personal tax (PT)

paid to the government and it is disposed by household into either consumption (C) or saving (S). Therefore,

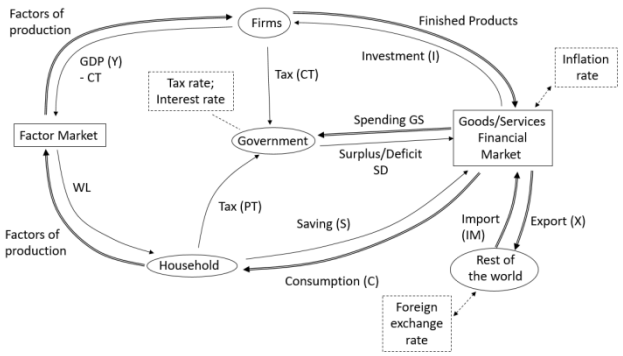

Figure 1: Circular flow model of GDP.

$$Y_{dis} = WL - PT = C + S \quad (2)$$

In addition, the proportion of money saved and consumed in one year is defined as the marginal propensity to save (MPS) and marginal propensity to consume (MPC) and they are estimated as

$$MPS = \frac{\text{Change in Savings}}{\text{Change in Disposable Income}} = 1 - MPC = \frac{dS}{dY_{dis}} \quad (3)$$

$$MPC = \frac{\text{Change in Consumption}}{\text{Change in Disposable Income}} = 1 - MPS = \frac{dC}{dY_{dis}} \quad (4)$$

Similarly, MPI is the marginal propensity to invest and is the ratio of change in investment to change in income. MPG is the marginal propensity for government spending and is the ratio of change in government spending to change in total income. MPM is the marginal propensity to import and is the ratio of change in import to change in income.

Moreover, to measure the change in aggregate production triggered by changes in an autonomous expenditure like consumption expenditures, investment expendi-tures, government purchases, or net exports, the expenditures multiplier is defined. The simplest form is to estimate the effect of the change in consumption on aggregate production.

$$\text{Simplest expenditure multiplier} = \frac{1}{(1-MPC)} = \frac{1}{MPS} \quad (5)$$

If other changes of expenditure are included, the sophisticated formula will be

$$\text{Expenditure multiplier} = \frac{1}{(1 - MPC - MPI - MPG + MPM)} \quad (6)$$

Another useful multiplier is the tax multiplier which is a ratio of the change in aggregate production to an autonomous change in government taxes. If consumption is the only affected expenditure, the simple tax multiplier is

$$\text{Simplest tax multiplier} = -\frac{MPC}{MPS} = -\frac{MPC}{(1-MPC)} \quad (7)$$

A negative sign is added to show that an increase in taxes will decrease the disposable income and a decrease in taxes will increase the disposable income. If other changes in expenditures are included, the sophisticated formula will be

$$\text{Tax multiplier} = -\frac{MPC}{(1 - MPC - MPI - MPG + MPM)} \quad (8)$$

3. Empirical Assessment

The following empirical assessment equation similar to that used by Barro and Redlick [2] is used to estimate the contribution of the percentage change of expenditure to the percentage GDP change.

$$\frac{(y_t - y_{t-1})}{y_{t-1}} = \alpha_C \frac{(C_t - C_{t-1})}{C_{t-1}} + \alpha_I \frac{(I_t - I_{t-1})}{I_{t-1}} + \alpha_G \frac{(G_t - G_{t-1})}{G_{t-1}} + \alpha_X \frac{(X_t - X_{t-1})}{X_{t-1}} + \alpha_{IM} \frac{(IM_t - IM_{t-1})}{IM_{t-1}} \quad (9)$$

where t stands for year t and $\alpha_1 \sim \alpha_5$ are the contribution of various percentage change of expenditure to the percentage GDP change. Here, y_t is the per capita real GDP at year t. The use of per capita value is to remove the effect of population increase. Data from Bureau of Economic Analysis are used in this study and they are separated into 1929-1950, 1950-1970, 1970-1990, and 1990-2017 so as to see the difference in various period. The results are listed in Table 1. In addition, Table 2 lists the estimated marginal propensity of various expenditure to GDP and the expenditure multiplier (EM) and the tax multiplier (TM).

In general, the multiple regression of Eq. (10) in four different periods are significant because the R^2 values are all larger than 0.98. Furthermore, the magnitude of the regression coefficients suggests that the change in consumption and the change in government expenditure dominates the percentage GDP change. During 1929-1950, when the Great Depression and the World War II happened, the contribution of investment and export was considerably low in comparison with its influence in the other three periods. Meanwhile, the positive import coefficient during the first period was different from the negative values in other three periods which indicates a different role of import on GDP from the conventional thinking as shown in Eq. (1). During 1950-1970, the peak individual tax rate was ranging 70%- 92% even with a tax cut in 1964, which was considerably high and persistent. The contribution of consumption was the highest among all expenditures and it was followed by the government expenditure, investment, export, and import. During 1970-

1990, when recessions dominated the first decade and the peak individual tax rate was about 70% while Reagan tax reform influenced the second decade, the contribution of consumption was the lowest in the four periods and the contributions of investment and government expenditure were the highest. During 1990-2017, the contribution of each expenditure was the highest among the four periods if the data during 1970-1990 was ignored. However, the average peak tax rates in 1990 – 2017 were the lowest among the four periods. Overall, the evaluation of the contribution of the percentage change of various expenditures on the percentage GDP change reveals a pattern that the consumption and the government expenditure dominated the contribution, and then it was followed by investment, export, and import. Also, if a significant change happened during the study period, such as the significant tax rate change during 1970-1990, the contribution of consumption might be lowered while the contribution of the investment and government expenditure might be raised.

The estimation of various marginal propensity of expenditures again shows the dominant role of consumption and government consumption. When estimating MPC, the R^2 values between GDP and consumption shows a range of 0.55 ~ 0.98 with MPC ranging between 0.397 ~ 0.693. The low value of 0.397 during 1930~1950 suggests that people tend to save more than consume during the wartime period. Otherwise, MPC increases with years and with the growth of economy. The R^2 values were poor between GDP and investment but MPI was reasonably ranging between 0.13 ~ 0.284. As to MPG, the R^2 value between GDP and government expenditure was poor during wartime period but were up to 0.89 during 1970~ 1990. It is worthy to note that MPG was highest during 1930 ~ 1950 and then gradually decreased to the latest period. In other words, the influence of the government expenditure on GDP has been weakening with the improvement of the U.S. general economic condition after World War II. This finding also indicates that the traditional approach of increasing government expenditure to stimulate the economic growth may not function positively as in the past. Finally, the R^2 value between GDP and import were reasonably acceptable and MPI was increasing from the wartime period up to now. In other words, the influence of importing goods on GDP was getting its momentum with years. It could be related to the improving economy and the practice of outsourcing overseas. With more and more products were manufactured abroad and sold in the U.S., the lowering costs have improved corporations' earning and the domestic economy.

Based on the above-estimated marginal propensity of various expenditure to GDP, the expenditure multiplier and tax multiplier in each period are also estimated and compared. The simplest expenditure multiplier ranging between 1.66 ~ 3.26 shows an increasing trend from the wartime period to the recent years. However, the sophisticated expenditure multiplier ranging from 3.65 ~ 208.27 shows a decreasing trend from the wartime period to the recent years. Clearly, the simplest expenditure multiplier reflects the increasing trend of MPC, while the sophisticated expenditure multiplier has been dominated by the decreasing trend of MPG, which indicates that the strengthening role of consumption on the economy has been offset by the weakening role of government expenditure. The differences between these two kinds of expenditure multiplier reflect the complexity involved in constructing the appropriate federal policy toward influencing the economic development. Appropriate policies must fit with the change of the economic environment to create the best outcomes.

As to the estimated tax multipliers, they show similar characteristics as the expenditure multipliers, except for their negative values. In other words, the absolute simplest tax multipliers increase with years, while the absolute sophisticated tax multiplies decrease with years. The reasons for causing these phenomena are similar to those related with the expenditure multipliers, except that the fact seems to suggest that the effectiveness of tax cut on increasing GDP may be weakening with years, if the sophisticated tax multipliers were considered. Still, the increasing simplified expenditure multipliers and simplified tax multipliers with years suggests that in comparison with the policy of increasing government expenditure, tax cut turns out to a better policy on stimulating the economy.

According to Laffer [3], the arithmetic effect of tax cut would directly lower the tax revenue which may hence lower the government income and the government expenditure and affect negatively on the economy. However, the increasing simplified tax multiplier with years show an opposite performance of the arithmetic effect of tax cut. In other words, the economic effect of tax cut would drive up more consumption and investment to stimulate the growth of economy when individuals and businesses are enjoying less tax burdens. According to Laffer [3], such economic effect happens when tax rates reach a prohibitive range in the Laffer curve. Figure 1 shows the ratio of total tax revenue to GDP which was low in early years and increased up to a peak of 15.2% in 1942 during the World War II. Later, the contribution of tax revenue to GDP varied but it remained above 9.7%. Since the U.S. adopts the progressive tax system with higher tax rates in the higher tax brackets, the phenomena of the increasing simplest tax multiplier echoing with the economic effect of the Laffer curve suggests that the tax contribution to the economy remains at a high level and can be a suitable target for stimulating economy when it is necessary. These findings support the tax cut efforts did by the Kennedy administration in 1963 and 1964, the Reagan administration in 1981 and 1986, the Bush administration in 2001 and 2003, and the Trump administration in 2017 [4].

Table 1 The estimated contribution of various percentage change of expenditure to the percentage GDP change.

	1929-1950	*1950-1970*	*1970-1990*	*1990-2017*
R^2	0.98	1.00	1.00	0.992
α_C	0.638	0.658	0.565	0.690
α_I	-0.002	0.141	0.184	0.163
α_G	0.162	0.181	0.248	0.181
α_X	0.000	0.038	0.082	0.095
α_{IM}	0.203	-0.033	-0.084	-0.137

Table 2 The estimated marginal propensity of various expenditure to GDP and the expenditure multiplier (EM) and the tax multiplier (TM).

	1929-1950	*1950-1970*	*1970-1990*	*1990-2017*
R^2 (GDP, C)	0.53	0.95	0.98	0.97
MPC	0.397	0.555	0.635	0.693
R^2 (GDP, I)	0.09	0.52	0.53	0.49
MPI	0.130	0.196	0.192	0.284
R^2 (GDP, G)	0.28	0.68	0.89	0.42
MPG	0.518	0.255	0.190	0.120
R^2(GDP, IM)	0.63	0.91	0.77	0.42
MPM	0.049	0.068	0.123	0.268
EM simplest	1.66	2.25	2.74	3.26
EM	208.27	16.16	9.38	3.65
TM simplest	-0.66	-1.25	-1.74	-2.26
TM	-82.62	-8.97	-5.96	-2.53

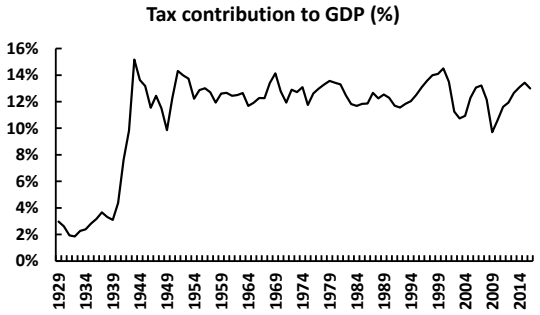

Figure 1: The ratio of the personal tax revenue and corporate tax revenue to GDP.

4. Conclusion

Expanding government expenditure on public projects or reducing individual and business tax burdens are two major governmental policies adopted for stimulating the economy. In the past, various policies were deployed during different periods when the political and economic conditions required. The contribution study shows that the percentage change of consumption and government expenditures dominated the percentage GDP change. However, during 1970-1990, when the first decade was with frequent recessions and a high peak individual tax rate of 70% while the second decade was accompanied with the Reagan tax cut with the peak rate down to 50% then 28%, the contribution from consumption was lowered while that from investment and government expenditure was raised. The phenomenon might be associated with a significant change of tax rates during this study period. Otherwise, in other periods, the percentage GDP change was affected by the percentage change of consumption, government expenditure, investment, export, and import, in sequence.

During 1929-1950, recession and war dominated the development. Hence, high tax rates and government spending were the major theme, although lawmakers did try to cut tax rates after the World War II. Data reveals that MPG was about 0.518 in the first period and it was the largest in comparison with MPG in other three periods, while MPC, MPI, and MPM were all the lowest in comparison with the same parameters in other three periods. Later, in other three periods, MPG shows a decreasing trend with years, while MPC increased with years. During 1990-2017, MPC was about 0.693, while MPG was just 0.12. In the meantime, the absolute values of the simplest form of expenditure multiplier and tax multiplier, both being affected mainly by MPC, show an increasing trend of years. The result suggests that the policy of increasing government expenditure might be effective on influencing the economy during 1929-1950 but its strength was decreasing with years. In the meantime, the tax cut policy might be a better option to choice for influencing the economy in the recent years due to the increasing contribution of consumption on GDP.

Furthermore, MPI and MPM are increasing with years which echoes with the increasing MPC with years and suggests that the current economy is influenced mainly by individual consumption, investment, and import. Therefore, reducing individual and business tax burden is very likely to result in more consumption and investment and hence the growth of economy. However, the decreasing trend of MPG and an increasing trend of government expenditure could make the effort of tax cut weakened. This is shown in the decreasing trend of the absolute values of expenditure multiplier and tax multiplier. In other words, a better control of government expenditure might determine the effec-tiveness of the recent Trump tax cut effort. Finally, the plot of the contribution of personal and business tax revenues to GDP shows that the current tax rates might remain in the prohibitive range of the Laffer curve because the con-tribution remained between 9.7% - 15.2% since the World War II. In other words, lowering personal and business tax burdens, such as Trump tax reform, to stimulate the economy does pose as a reasonable choice at the current stage.

Acknowledgements

Helpful comments from Dr. Robert Gottfried Kuklik are highly appreciated.

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A SIMPLIFIED APPROACH TO ASSESS TRUMP TAX REFORM ON GDP

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Abstract: *This study develops a simplified empirical macroeconomic model to assess Trump tax reform on GDP. The model assumes linear relationships among various economic parameters and separates the past economic data into four different periods so as to better capture the fluctuations of the longtime political and economic changes. In principle, for assessing the effect of Trump tax reform, the model assumes a continued economic condition from 1990-2017 to the later years. Since the economic responses to tax cut should be more vigorous than the past, hence the model can be viewed as a reasonable but understated shortcut for the evaluation task. The result shows that the average annual ratio of total tax revenue to GDP will decrease from 13.1% in 2014 – 2017 to 8.84% in 2018-2021. In the meantime, the average annual growth rate of GDP will increase from 2.3% in 2014 - 2017 to 3.7% in 2018-2021, which is a rise of 1.4%. In the future, the simplified model will be modified to allow more active economic responses to tax cut, interest rate rise, and others, so as to offer a better evaluation of the effect of Trump tax reform. Still, the reliability of such evaluation studies may be affected by the future government expenditure and the growth of federal debts, because they may drive up interest rate and inflation rate, crowd out investments, and hence weaken the economic growth.*

Keywords: *Macroeconomic model, Trump tax reform, tax cut, assessment*

1. Introduction

On Dec. 22, 2017, President Trump signed the Tax Cuts and Jobs Act to cut the corporate tax rates permanently from the current top rate of 35% to a single tax rate of 21%, and to cut temporary the personal income tax rates including the peak of 39.6% to 37% until 2025. Also, the Act doubles the standard deduction, eliminates personal exemptions, limits the mortgage interest and the state and local taxes deduction, doubles the estate tax exemption, increases the child tax credit, raises the standard deduction to 20% for pass-through entities, eliminates the corporate alternative minimum tax, changes the worldwide tax system to the territorial system, and sets the one-time tax rate of 15.5% on corporate's repatriated foreign cash profits and 8% on equipment [1].

Historically, Trump administration's effort is the sixth major tax-cut events in the U.S. after Harding and Coolidge administrations' tax cuts in 1921 and 1923, lawmakers' tax cut efforts in 1945, 1946, and 1948, Kennedy and Johnson administration's tax cut in 1964, Reagan administration's tax cut in 1981 and 1986, and Bush administration's tax cuts in 2001, 2002, and 2003 [2]. The ultimate goal of Trump tax reform is to increase jobs in the U.S. and to offer historic tax relief to families and business with an intention to simplify the tax code and to create incentives for business investment and growth [3]. Optimistically, based on Reagan administration's tax-cut experience, Trump administration is expecting to see an annual GDP growth in excess of 3% in the coming years with a boost to business growth and tax returns [4].

Traditionally, expanding government expenditures to stimulate the economy was the major economic policy exercised by the U.S. federal government. For instance, Hoover and Roosevelt administrations initiated a series of public projects and raised tax to fund the government expenditure [5]. Furthermore, after 1950, federal budget deficits became a norm and often reached an averaged 3% of GDP, which shows that the government often spent more than what it had received [6]. In the meantime, Reagan administration adopted the idea of Laffer curve that cutting tax when tax rates fell in a prohibitive range would drove up investment, consumption, and hence the economy. Such tax cut policy has also been deployed a few times in the U.S. history including Trump tax reform [2].

A few preliminary assessments of Trump Tax reform emphasize the positive economic effect of tax cuts and project that GDP will increase about 0.7% relative to the baseline over a 10-year period [3], or about 0.8% in 2018, 0.9% in 2019, and 0.5% annually by 2025 [8], or about 1.7% over the long term [9]. In addition, the increase in output is expected to boost revenues and reduce deficit [3]. Roughly, in this paper, an effort to assess the macroeconomic effect of Trump tax reform will be exercised with a simplified empirical macroeconomic model so as to present a transparent procedure for understanding the interactive processes involved in the economic assessment.

2. Simplified Macroeconomic Model

The circular flow model of GDP shown in [10] is adopted. In the model, products flow clockwise while money flows counter clockwise. The factors of production include labor, land, raw materials, etc. GDP (Gross Domestic Product) is estimated by the final sales (or expenditure) method [11] and is the summation of consumption (C), investment (I),

government expenditure (G), and net export (NX), which is the difference between export (X) and import (IM). Hence,

$$\begin{aligned} \text{GDP} &= \text{Y} = \text{Aggregate demand} \\ &= \text{Consumption} + \text{Investment} + \text{Government Expenditure} + \text{Export} - \text{Import} \\ &= \text{C} + \text{I} + \text{G} + \text{X} - \text{IM} \\ &= \text{C} + \text{I} + \text{G} + \text{NX} \end{aligned} \quad (1)$$

In the meantime, the corporate tax (CT) and the personal tax (PT) influence the government receipt and the government deficit. The influence can be minimized if the government controls its spending carefully. Also, the tax rate, interest rate, inflation rate, and foreign exchange rate are influential factors to the flows of products and capital.

To assess tax reform on GDP, a simplified empirical macroeconomic model is developed. The aggregate demand Y is assumed to be

$$\begin{aligned} Y &= C + I + G + X - IM \\ &= C + s\,Y + G + p\,Y - qC \end{aligned} \quad (2)$$

where the investment ($I = sY$) and the export ($X = pY$) are proportional to the aggregate demand (Y) and the import ($IM = qC$) is proportional to the consumption (C). These linear relationships are proven to be statistically significant. In the meantime, the government expenditure (G) is equal to

$$\begin{aligned} &\text{Government expenditure} \\ &= \text{Personal tax} + \text{Corporate tax} + \text{Government spending} \\ &= PT + CT + GS \\ &= PTR\,WL + CTR\,CP + GS \end{aligned} \quad (3)$$

where the effective personal tax rate is PTR; the per capita wage is W; the total employed labor $is\ L$. Therefore, the total personal disposable income (Y_{dis}) can be estimated as the total personal income (WL) minus the personal tax (PT) paid to the government. In the meantime, the effective corporate tax rate is CTR. The corporate profit is CP ($= rY$), which is assumed to be proportional to the investment (I) and hence the aggregate demand (Y). As to the government spending (GS), it is mainly determined by the government and is an exogenous variable in the model. Similarly, PTR and CTR are also exogenous variables.

Therefore, Eq. (2) can be modified to be

$$\begin{aligned} Y - s\,Y - p\,Y - CTR\,r\,Y \\ = (1-q)\,C + PTR\,WL + GS \end{aligned} \quad (4)$$

or

$$Y = \frac{[(1-q)C + PTR\,WL + GS]}{(1-s-p-CTR\,r)} \quad (5)$$

The per capita wage W and the total employed labor L are assumed to grow with a steady growth rate, β and δ, respectively. Therefore,

$$W_{t+1} = W_t(1+\beta);\ L_{t+1} = L_t\,(1+\delta) \quad (6)$$

Furthermore, the consumption (C) is assumed to be a function of the disposable income (Y_{dis}), i.e. $C = \lambda\,Y_{dis}$, while Y_{dis} is expressed as

$$\begin{aligned} Y_{dis,t+1} &= W_{t+1}\,L_{t+1} - PT_{t+1} \\ &= (1 - PTR_{t+1})\,W_{t+1}\,L_{t+1} \end{aligned} \quad (7)$$

The change of personal tax rate will therefore affect the personal disposable income and hence the consumption.

In Eq. (5), the change of personal tax rate (PTR) will directly affect the consumption and influence the change of GDP with the change of the corporate tax rate and the government spending together. In the meantime, the change in investment, export, and import will be indirectly reflected through the change of GDP. This simplified empirical approach fits with the previous finding that the consumption and the government expenditure dominate the change of GDP much more effectively than the other expenditures [10].

In the following, the related parameters are derived and listed in Table 1 for the 1929-1950, 1950-1970, 1970-1990, and 1990-2017 periods. Data used are collected from the Bureau of Economic Analysis and the Bureau of Labor Statistics. The reason to separate the whole dataset into four periods is because the domestic financial condition varies with years and the approach provides a better fit to the changing economy. In general, the first period covers the Great Depression, World War II, and the lawmakers' tax cut efforts in 1945, 1946, and 1948; the second period covers Korean War, baby boom, cold war, post-World War II strong economic expansion, Vietnam war, and Kennedy and Johnson administration's tax cut in 1964; the third period covers cold war, oil crisis, the end of Vietnam war, and Reagan administration's tax cut in 1981 and 1986; and the fourth period covers the end of cold war, the dot-com bubble, 9-11 terrorists attack, Bush administration's tax cuts in 2001, 2002, and 2003, the 2008 financial meltdown, and the quantitative easing efforts. Clearly, the different political and financial influences happened during these four different periods would be reflected directly on the variation of GDP. The approach of seeking different parameters in different time period would be a reasonable strategy to catch different economic signals so as to simulate more closely to the real observed GDP. Finally, the parameters derived in the final period will be used for the estimation of the effect of Trump tax reform on GDP in the following years.

In general, the R^2 values shown in Table 1 are all over 0.8 which suggests that the proposed relationships including $I = sY$, $X = pY$, $IM = qC$, $C = \lambda\,Y_{dis}$, $CP = rY$, $W_{t+1} = W_t(1+\beta)$, and $L_{t+1} = L_t\,(1+\delta)$ are all quite reasonable. Among those parameters, p and q show an increasing trend with years which meets with the expectation of the growing importance of the international trend to the domestic economy. Otherwise, the large λ

value fits with the major characters of the capitalism market that the consumption dominated the usage of the personal disposable income. The comparison of the model estimated GDP and real observed GDP during 1929 – 2017 shows that the root-mean-square-value (rms) is just about 8.4% of the mean observed GDP which suggests that the model does fit quite well with the real situation. However, the model still fails around 1990 when the end of cold war and the Iraqi-war induced oil price shock happened, and around 2006 ~ 2009 when the financial meltdown occurred. This phenomena suggest that the model may become unsatisfactory around 1990 when parameters of two different periods are linking together and at times when a dramatic economic event such the financial meltdown happened.

Table 1 Parameters used in the simplified macroeconomic model.

	1929-1950	*1950-1970*	*1970-1990*	*1990-2017*
I = s Y				
R^2 (I, Y)	0.84	1.00	1.00	0.99
s	0.125	0.165	0.182	0.168
X = p Y				
R^2 (X, Y)	0.89	0.99	0.99	0.98
p	0.045	0.050	0.082	0.117
IM = q C				
R^2 (IM, C)	0.99	0.99	0.99	0.99
q	0.055	0.076	0.158	0.224
CP = r Y				
R^2 (CP, Y)	0.95	0.99	0.97	0.96
r	0.116	0.101	0.075	0.109
$C=\lambda Y_{disp}$				
R^2	0.99	1.00	1.00	1.00
λ	0.864	0.866	0.878	0.911
$W_{t+1}= W_t (1+\beta)$				
R^2	0.81	0.96	0.99	0.99
β	0.050	0.055	0.060	0.033
$L_{t+1}= L_t (1+\delta)$				
R^2	0.80	0.94	0.99	0.89
δ	0.011	0.015	0.020	0.009

Further study suggests that more elaborated efforts can certainly improve the details of the model, except for the dramatic finacial meltdown event, but such exercise may not be necessary because the main purpose of this study is to evaluate the effect of Trump tax reform and it is not to imitate the change of GDP throughtout the U.S. history. Besides, the growth model of W and L shown in Eq. (6) is commonly used in the macroeconomic study and it is appropriate to be extended to a short period beyond the current simulation period for evaluating the effect of Trump tax reform.

Overall, the study in this section supports the usefulness of the developed simplified macroeconomic model in reasonably simulating the variation of GDP and to be applied in the tax reform study. In the model, as long as the exogenous variables, including the effective personal tax rate (PTR), the effective corporate tax rate (CTR), and the government spending (GS), are given with the reflection of Trump tax reform signals, then the simplified macroeconomic model would be able to estimate of the effect of tax reform on GDP.

3. Assessing Trump Tax Reform

To use the simplified empirical macroeconomic model, tax income data generated by the Joint Committee on Taxation (JCX) [12] is used because JCX has complete tax microsimulation models to simulate the individual tax, business tax, estate tax, and others [13] [14]. Based on the estimation, a reduction of personal tax income, a reduction of business tax income, and an increase of international tax income caused by the Tax Cuts and Jobs Act after 2018 can be obtained [12]. An increase of international tax income happens because of the receipt of the one-time tax on the corporate repatriated oversea profits. In addition, the government consumption expenditures and gross investment (G), which is needed to estimate the government spending (GS), after 2018, can be estimated from the recent budget proposal of Trump administration [15]. Based on the information stated above, the exogenous variables, including the effective personal tax rate (PTR), the effective corporate tax rate (CTR), and the government spending (GS), in 2018 – 2021, can be estimated and implemented into the simplified macroeconomic model for evaluating the macroeconomic effect of Trump tax reform.

In this study, a four-year period before and after the tax cut is selected for comparison as suggested by Laffer [16] and applied by Lee [2]. A few selected economic indicators are estimated, listed, and compared in Table 2 as done by Lee [2]. Based on the tax projection by JCX [12], the average annual total tax revenue growth rate was 4.2% before the tax reform but it will become -10.5% after. Also, based on the budget projected by White House [15], the average annual government expenditure growth rate will change from 1.6% before the tax reform to rise to 4.9% in 2018 – 2021. Interestingly, the average annual real GDP growth rate will increase from an averaged 2.3% in 2014 - 2017 to become 3.7% after the tax reform, which is to increase by 1.4%. In the meantime, the average annual ratio of total tax revenue to GDP will decrease from 13.1% before to 8.84% after.

Table 2 Economic indicators before and after Trump tax cut

Average annual	Ratio of total tax revenue to GDP	Real GDP growth rate	Unemploy-ment rate	Govern-ment expendi-ture growth rate	Total tax reve-nue growth rate
Before (2014-2017)	13.1%[1]	2.3%[1]	5.2%[2]	1.6%[1]	4.2%[1]
After (2018-2021)	8.84%[3]	3.7%[3]	4.7%[3]	4.9%[4]	-10.5%[5]

[1][17]; [2][18]; [3]Estimated by the simplified macroeconomic model; [4] [15]; [5][12].

In this process, the arithmetic effect of tax cuts, which is to lower tax revenues to the government [16], does cause the reduction of government's tax income but it doesn't affect the GDP growth. The reason is because the simplified macroeconomic model assumes a continued growth of the employed labor (L) and per capita wage (W) by Eq. (6), a continued linear relationship of investment (I), export (X), and corporate profit (CP) with GDP (Y), a continued linear relationship between import (IM) and consumption (C), and a continued linear relationship between consumption (C) and personal disposable income ($Ydisp$). Also, the effects of the change of interest rate, inflation rate, and foreign currency exchange rate on the economy have been assumed to remain unchanged in the model as in the last study period. In other words, the full responses of the economic effect of tax cuts, such as a decrease of tax burden boosting the investment, consumption, job market, and wage [16], is not stimulated in the model. Instead, the economic condition stays similar to that during 1990 – 2017.

4. Conclusion

The result shows that the average annual ratio of total tax revenue to GDP will decrease from 13.1% before the tax reform to 8.84% after, while the average annual real GDP growth rate will increase from an averaged 3.8% in 2014 - 2017 to become 5.7% in 2018 - 2021, which is a rise of 1.9%. Basically, the simplified empirical approach of assuming a continued economic growth pattern as in 1990-2017 presents a less vigorous economic projection as Trump tax reform would be expected. Therefore, the projected GDP growth can possibly be viewed as an underestimated situation. However, even though the current model is not capable of stimulating the full functions of the economic effect of a tax cut, the current simulated result can be viewed as a simplified and understated evaluation. In the future, more efforts will be applied to strengthen the current simplified model to generate more dynamic responses to the economic fluctuation and to provide a more realistic estimation of the effect of Trump tax reform.

Acknowledgement

Helpful guidelines and comments from Dr. Robert Gottfried Kuklik are highly appreciated.

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SELF-EMPLOYMENT AND THE RIGHT OF ASSOCIATION IN TRADE UNIONS

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Abstract: *The aim of this paper is the analysis of the subjective scope of the right of association in trade unions and the possibility of covering by it self-employed persons who, without entering the employment relationship, act as sole traders. This issue was examined by the Constitutional Tribunal which – in its judgement of 2 June 2015 (K 1/13) – considered unconstitutional the provision of Art. 2(1) of the Polish Act on trade unions with respect to its restriction on the freedom to form and join trade unions imposed on the persons performing paid work who are not listed in the said provision. Analysis of the international law and the Polish Constitution in relation to the subjective scope of the right of association in trade unions explicitly confirms the legitimacy of the proposal to introduce to the Polish Act on trade unions the right of alliance for the self-employed who perform work on their own account and at their risk within their business activity. Certainly, the right of alliance should exclude those of the self-employed who when performing work (providing services) take advantage of the third parties' help by employing workers or engaging subcontractors. They most often as employers have the possibility to associate in organizations of entrepreneurs. Other limitations on the right of alliance for the self-employed, are unacceptable as contradictory to the freedom of association in trade unions.*

Keywords: *self-employment, trade unions, autonomous work, labour law, the right of association in trade unions*

1. Introduction

The right of alliance is the freedom of association in trade unions, understood as the right to form new and join the existing trade organizations for the purpose of protecting and representing rights and interests of workers. This is also one of the most important guarantees of collective labour law which has its grounds both in international and Polish law, in particular in the provisions of the Constitution of the Republic of Poland. The guarantee is present also in the legal systems of all the developed countries. It is of particular significance for the Polish system, due to the statutory monopoly of trade unions with respect to securing such fundamental rights resulting from collective labour law as: the right to collective bargaining, in particular in order to resolve collective disputes; the right to enter collective labour agreements and other arrangements; as well as the right to organize strikes and other forms of protest, as allowed by statute. Under Art. 59(2) and (3) of the Constitution of the Republic of Poland, the above-mentioned rights must not be exercised by any other entity acting as one of the forms of association provided for by law, which highlights the social significance of trade organizations. The aim of this paper is the analysis of the subjective scope of the right of association in trade unions and the possibility of covering by it self-employed persons who, without entering the employment relationship, act as sole traders. This issue was examined by the Constitutional Tribunal which – in its judgement of 2 June 2015 (K 1/13) – considered unconstitutional the provision of Art. 2(1) of the Polish Act on trade unions with respect to its restriction on the freedom to form and join trade unions imposed on the persons performing paid work who are not listed in the said provision. In the view of the Constitutional Tribunal, the defect of this statutory provision results from its too narrow subjective scope, which makes it impossible for a group of persons being addressees of the freedom to enjoy the freedom of association in trade unions, stipulated in Art. 59(1) in conjunction with Art. 12 of the Constitution. The Tribunal included in this group the self-employed, indicating that the legislator has an obligation to differentiate, mainly among the self-employed, between those who have all the features of workers and must have the possibility to associate in trade unions and those who are regarded as entrepreneurs. The latter group should enjoy the freedom of association in organizations of entrepreneurs. In this paper, I intend to focus on the problem of how the right of the self-employed to associate in trade unions should be regulated in Poland.

2. Methodology

The author of this paper applies several research methods, since the multi-level nature of the analysed issues does not allow one to be limited to one approach only. The comparative research method will be extensively used, in particular when it comes to the comparison of the international normative system referring to the right of association in trade unions and the Polish regulations. A logical and linguistic as well as axiological approach will also be followed in the study. In addition, in the light of the raised questions, historical and statistical methods are applicable. The author's multi-level perspective when analysing the legal issue and the above methods, which permeate and complement one another in the research on self-employment, contribute to the in-depth and multi-faceted study of the problem.

3. Subjective scope of the right of association in trade unions in the light of international and Polish law

The analysis of international regulations clearly indicates the extensive subjective scope of the right of association in trade unions. This can be observed on the example of both

the regulations of the United Nations Organization (UNO) and the International Labour Organisation (ILO), as well as the Council of Europe (CoE) legal norms. The UNO regulations, when specifying the subjective scope of the right to associate in trade unions, stipulate that it is enjoyed by "everyone". In accordance with Art. 22 of the International Covenant on Civil and Political Rights of 1966, "Everyone shall have the right to freedom of association with others, including the right to form and join trade unions for the protection of his interests." The ILO Convention No. 87 of 1948 on Freedom of Association and Protection of the Right to Organise, ratified by Poland on 25 February 1957, is of key significance for the discussed issues. The convention indicates that the essence of the right of association is the possibility for all workers to freely form trade unions of their choice, without the need of obtaining permission from the state authorities. In compliance with Art. 2 of the ILO Convention No. 87, workers (*travailleurs*) and employers, without any distinction, have the right to establish and, subject only to the rules of the organisation concerned, to join organisations of their own choosing without previous authorisation. Therefore, the quoted convention does not limit the right of alliance exclusively to persons performing work based on the employment relationship (employees). What is more, it does not limit this right even to persons performing paid work. The expression "workers without any distinction" means that the right of association in trade unions is guaranteed to all persons performing occupational work, also based on civil law contracts and as outwork. Under the ILO Convention No. 87, the only criterion which helps to define the subjective scope of the right of alliance is the performance of work. The interpretation of Art. 2 of the ILO Convention No. 87 presented above is concordant with its Art. 9, which allows limitations on the freedom of association in trade unions only in case of professional police officers and persons serving in armed forces. The provision is regarded as an exception to Art. 2 of the Convention and, therefore, it must not be treated as extensive. Also the CoE regulations assume a broad scope of the right to form and join trade unions. In accordance with Art. 11(1) of the European Convention for the Protection of Human Rights and Fundamental Freedoms of 4 November 1950, everyone has the right to freedom of peaceful assembly and to freedom of association with others, including the right to form and to join trade unions for the protection of one's interests. Based on the quoted convention, also the European Court of Human Rights adopted a broad interpretation of the right of association [1].

The Polish constitutional legislator broadly defines the right of association as well. Under Art. 12 of the Constitution, the Republic of Poland ensures the freedom of establishing and operation of trade unions, social and occupational organizations of farmers, societies, citizens' movements, other voluntary associations and foundations, while Art. 58(1) guarantees the freedom of association to everyone. Article 59 of the Constitution, which under section 1 stipulates that the freedom of association in trade unions, social and occupational organizations of farmers, and in employers' organizations is ensured, is of key importance for defining the subjective scope of the right of alliance. Under Art. 59(4) of the Constitution, the scope of this freedom may be may only be subject to such statutory limitations as are permissible in accordance with international agreements to which the Republic of Poland is a party. Therefore, the above-mentioned regulations guarantee the right of association in trade unions to all workers who are covered by this right based on the international agreements ratified by Poland in the scope provided for therein. The Constitution of the Republic of Poland does not make in any way the right of association dependent on the type of employment. It is granted to everyone who, performing work, has specified economic or social interests directly related to occupational activity, which require to be collectively protected. This corresponds with the definition of a trade union adopted in the Act of 23 May 1990 on trade unions, in line with which – under Art. 1 – it is a voluntary and self-governing organization of workers, appointed to represent and protect their rights and occupational and social interests. In the light of the presented regulations, one should regard the statutory limitation of the subjective scope of the right to associate in trade unions and to join them as entirely unjustified and incompliant with the Constitution of the Republic of Poland and the international agreements binding on Poland. In accordance with Art. 2 of the Act on trade unions, the right to form and join trade unions is granted exclusively to employees, regardless of the basis of their employment relationship, members of farmers' cooperatives and persons performing work under agency agreements, provided they are not employers (section 1), as well as persons performing substitute service (section 5). The Constitutional Tribunal in the above-quoted judgment of 2 June 2015 concluded that the scope of the provision on admissibility of forming trade unions and joining them, as stipulated under Art. 2(1) of the Act on trade unions, is too narrow compared to the constitutional guarantees. When defining the group of entities entitled to form trade unions and to join them, the statutory legislator applied the criterion of the form of employment, which is not envisaged in the Constitution as a characteristic of entities exercising the freedom of association in trade unions. Those entities are characterised primarily by the fact of performing paid work for someone and having occupational interests which may be collectively protected by a trade union. It is not important in this context what form and basis of the performed work are. The adoption of this criterion by the legislator has led to a situation when a group of entities covered by the constitutional provision on the freedom of association in trade unions is not included in Art. 2(1) of the Act on trade unions, and hence has been deprived by statute of the possibility to form and join trade unions. That is why, the Constitutional Tribunal judged the quoted regulation unconstitutional and introduced the constitutional concept of a "worker", understood in a much broader way than the one present in the provisions of the Polish Labour Code (Art. 2 and 22 LC). In the view of the Constitutional Tribunal, the status of the worker as a constitutional subject of the freedom of association in trade unions – under Art 59(1) of

the Constitution of the Republic of Poland – should be assessed considering three essential criteria: performance of paid work; being bound by a legal relationship (irrespective of its type) with the entity for which the work is performed; having occupational interests related to performed work which may be collectively protected [2].

4. Concept of self-employment and a general tendency to extend the scope of protection

In Poland, since the beginning of the 1990s, a dynamic growth of flexible forms of employment has been observed, including "self-employment", which sometimes is referred to as "work on one's own account". In accordance with the recent OECD data, the phenomenon of self-employment in Poland concerns around 23% of total employees and this is a distinctly higher indicator than the average share for the EU countries, which fluctuates around 16%. The total number of the self-employed, in line with the Polish Central Statistical Office (GUS) research, accounts for 3 million. In the Polish legal system, there is no official definition of this concept. The difficulties related to interpretation of the term "self-employment" result from the fact that work performed on one's own account has a complex nature, and what is more, a number of different activities may be performed within its framework. The concept of self-employment covers natural persons conducting business activity as sole traders based on the entry in the register, but also natural persons acting as a civil law company or as freelancers. In Poland there is no legal definition of self-employment, despite the fact that the legislator partially regulates the legal situation of this group. In the European Court of Justice case law, it is assumed that this is an economic activity carried out by a natural person outside the employment relationship of subordination with respect to work and pay conditions, performed under one's own responsibility in exchange for remuneration paid directly and in full to that person (Judgement of 20 November 2001 in Case C-268/99 – concerning self-employed prostitutes in the Netherlands). For the purposes of the foregoing paper, it should be assumed that self-employment consists in providing services (work) for the benefit of one or several (many) commissioning entities by natural persons carrying out economic activities under their own responsibility and at their risk in the character of entrepreneurs, without the possibility of hiring employees or using other persons' work based on civil law contracts [3]. One can, therefore, identify two categories of the self-employed, i.e. the dependent self-employed and the independent self-employed [4].

We have been recently observing both in the Polish legislature and in the regulations of many European states, a trend aiming at extending of some of employment rights, which so far have been reserved exclusively for the employment relationship, to cover workers under civil law contracts, including also the self-employed. This trend is, to a large extent, an outcome of the adaptation of the national legal systems to the international and EU law. In Poland, this is also a consequence of adapting labour law to the requirement of the Constitution. In *de lege lata* Polish law, persons providing work (services) under civil law contracts are safeguarded by law with respect to: life and health, which concerns all workers (also the self-employed) performing their job at the premises of the employer; ban on discrimination and the requirement of equal treatment in employment; guaranteed minimum pay and protection of the remuneration for work as well as protection of maternity and parenthood. Therefore, a question must be raised whether the trend should be reflected in the rights resulting from the collective labour law. In the light of the binding regulations, the self-employed, due to the statutory exclusion from the right of association in trade unions, may not enjoy in any way most of the guarantees of the collective labour law, in particular: the right to bargain, also with the purpose of resolving collective disputes; the right to enter collective labour agreements and other normative arrangements; or the right to organise strikes and other forms of protest, as provided for in statute. The only right which, in fact, is granted to the self-employed in *de lege lata* collective labour law is the possibility of being covered by the collective labour agreement which has previously been concluded for employees of the entity organising their work. In accordance with Art. 239 § 2 of the Labour Code, the agreement may cover persons performing their work based on grounds other than the employment relationship. Moreover, it is admissible to organise protests without the participation of trade unions, yet they must be compliant with legal provisions, in particular the Act of 5 July 1990: Law on assemblies.

5. Right of the self-employed to associate in trade unions

The above presented analysis of the international law in relation to the subjective scope of the right of association in trade unions explicitly confirms the legitimacy of the proposal to introduce to the Polish Act on trade unions the right of alliance for the self-employed who perform work on their own account and at their risk within their business activity. The necessity of regulating this issue results also from the Polish Constitution which provides for the freedom of association in trade unions, irrespective of the form of performing work, and its scope may be subject to only such statutory limitations which are permissible under the international agreements signed by the Republic of Poland. Moreover, under Art. 31(4) of the Constitution of the Republic of Poland, it is stipulated that the limitations on exercising the constitutional rights and freedoms (in this case the freedom of association in trade unions, which gives rise to the right of alliance) may be imposed only by statute and solely when those are necessary in a democratic state for its security or public order, or to protect the environment, health and morals, or rights and freedoms of others, and the restrictions may not infringe upon the essence of the rights and freedoms. None of the above-listed circumstances justifies the possibility to deprive the self-employed of the right of association in trade unions. This is confirmed also by the Constitutional Tribunal in its judgement of 2 June 2015, indicating that the right of association, under Art. 59(1) of the Constitution of the Republic of Poland, should be exercised by persons (workers, as defined by the Constitution) who meet the following criteria: they perform paid work; they are bound by a legal relationship

(irrespective of its type) with an entity for which the work is performed; they have occupational interests related to performed work which may be collectively protected. All of them seem in principle fulfilled with reference to the self-employed who perform their work (provide services) on their own account and at their risk as their business activities. Those persons, as entrepreneurs, as a rule conduct economic activities for financial reasons, in order to earn profit. The self-employed usually perform work (services) for their clients under civil law contracts for providing services (referred to as business contracts), and rarely under an agency agreement or a specific work contract. The third premise concerning the occupational interests related to performed work which may be collectively protected also seems complied with by the self-employed. Without doubt, those persons should be included in the group of "workers", as defined in the Polish Act on trade unions. In accordance with the Act, a trade union is a voluntary and self-governing organization of workers, appointed to represent and protect their rights, and occupational and social interests. That is why, it is particularly necessary to guarantee the right of alliance to the self-employed, which would enable them to effectively protect their occupational and social interests. Those persons, when performing work under civil law contracts, do not enjoy the statutorily guaranteed protection of their minimum rights (apart from the right to minimum pay), which is granted *ex lege* only to employees in the employment relationship. Therefore, they do not have the statutory privileges in the area of: paid annual holiday and other paid breaks in performed work; maximum work time limits; daily and weekly rest; remuneration for the period of incapacity to work due to illness; statutory work benefits and redundancy pays, compensations and damages; as well as protection of continuity of the legal relationship which is the basis for the performed work (provided services). Due to the principle of freedom of contracts, applicable in the civil law, it is quite common that an entity commissioning work (service) imposes unfavourable terms and condition on the self-employed, and the equality between the parties in this case is only apparent. The need to cover the self-employed with the trade union protection results also from the fact that they perform their work (services) in conditions of far-reaching and multi-level dependence on an entity employing them, which, although it cannot be identified with the employer-employee type of subordination, puts them in a position similar to that of employees. The manifestation of this dependence may be, for instance: supervision of performed tasks; assessment of the effects of work; subordination as to the place and time of performed work and order and work arrangements in the workplace of the commissioning entity; and finally, economic dependence on the commissioning entity. The above means that the majority of the self-employed is a group having their occupational, economic and social interests related to work performed under their business activity, which should be collectively protected by trade unions.

6. Conclusions

The above discussion proves that in the light of the international and constitutional law, the self-employed should have a guaranteed full right to associate in trade unions. A question arises: should the right be granted to all of them? The answer is negative. Certainly, the right of alliance should exclude those of the self-employed who when performing work (providing services) take advantage of the third parties' help by employing workers or engaging subcontractors. They most often as employers have the possibility to associate in organizations of entrepreneurs. Other limitations on the right of alliance for the self-employed, such as the requirement of economic dependence on the commissioning entity (performance of work for only one entity) or the requirement of incessant performance of work (services) for a given entity for the period of at least 6 months (as it has been proposed in the doctrine), are unacceptable as contradictory to the freedom of association in trade unions [5]. The right of alliance granted to the self-employed in a broad way will make it possible for them to enjoy other guarantees of the collective labour law, such as: the right to bargain, in particular in order to resolve collective disputes; the right to conclude collective labour agreements and other arrangements; as well as the right to organise strikes and other forms of protest [6]. Those rights may be limited already by the statutory legislator with respect to the self-employed by means of introducing additional criteria the fulfilment of which will make it possible to exercise the rights.

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THE STRUCTURE OF REVENUES IN FOOTBALL IN POLAND AND SLOVAKIA

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Abstract: *For sustainability and success of all sports club are revenues one of the key factors. The paper shows a closer look at two geographically close countries, but with different position of football in a culture of nations and its influence on revenues structure of clubs. This paper includes the theoretical basis of revenues in football, closer look at football in Poland and Slovakia and comparison of revenues distribution of top division football clubs in the same countries.*

Keywords: *revenues, sport, football, Poland, Slovakia*

1. Introduction

Football for years arouses extreme emotions among fans. In some countries, it has become a national discipline, gathering audiences at stadiums or in front of the TV. Football events make fans identify with their teams, purchase clubs gadgets, and create a certain football culture. The growing popularity of players creates the transfer market and leads to an increase in spending in football clubs. In turn, increasing financial flows in clubs cause an increase in the demand for analyzes that may support the decision-making process.

2. Revenues

Revenue is an inflow of assets or other increase of assets of a given entity or reduction of its liabilities (or a combination of the above) resulting from the provision or production of goods, provision of services or other activities being the basic activity of a given entity. [1] The term "revenues" includes various types of transactions affecting the size of the financial result. There are three kinds of revenues. [2]

Usually the most important is the top line, which consists in the transferring to the buyer any rights to dispose of the objects of transactions in exchange for the payment of a specified price. Top line is defined as the value of sales, which is established as the sum of the products of the quantity of goods, products, and services sold and the unit price applicable to them. Operating incomes are revenues related to the operating activity of the entity. These revenues are presented in two parts of the profit and loss account. Financial revenues are incomes earned in financial and investment activity. [3]

3. Revenues in football

Main sources of revenues for football clubs in Europe are domestic broadcasting, revenues from UEFA (Union of European Football Associations), gate receipts, sponsorship/commercial and other such as merchandise, transfers, renting stadium for concerts etc.

3.1 Domestic broadcasting

The rights to domestic and international television (or the international and domestic media rights) are a key part of the club's income. Most European leagues are watched all over the world, which brings money to the teams. The English Premier League is the leader in revenues from broadcasting rights in football.

3.2 Revenues from UEFA

This kind of revenues included money from UEFA divided to clubs by national associations. For more successful clubs it means prize money from competitions organized by UEFA (Champions League, European League etc.) too.

3.3 Gate receipts

Matchdays are always an exciting moment for football clubs. Players are in action on the pitch, the fans are playing in the stands, and the owner is happy that the latest batch of cash will go to his account. Jokes aside, the revenues from ticket sales is extremely important for football clubs. Money from the sale of match and seasonal tickets is needed for the daily functioning of clubs.

3.4 Sponsorship/commercial

For most of clubs is this the biggest revenues channel of all. Sponsorship can have different meanings. Main idea is to connect club or players to sponsor's brand in the most visible and understandable way, for example name of sponsors on the kit. There are also clubs, who gain money through naming rights of club (Fenerbahçe Doğuş) or stadium (Emirates stadium). This is called brand partnerships or co-branding in the marketing world.

4. Football in Poland

The creation of a football system in Poland (at first only male) was initiated in December 1919 during the Founding Assembly of the Polish Football Association. Over the years, it has undergone numerous changes, in terms of hierarchy, naming, and territorial coverage. On 25th of September 2006 the Board of the Polish Football Association adopted a draft reform of the system of men's league football matches in Poland, which on 7th of January 2007 was approved by a resolution of delegates during the General Meeting of Polish Football Association and became effective starting from the 2008/2009 season. From 2008 the central matches include four, not three as before, leagues: Ekstraklasa, the first league, the second league and the third league. Other levels are regional (provincial) or local. Ekstraklasa consists of 16 teams, the first league of 18 teams, the second league 18 teams as well and the third league is composed of 72 teams, which create 4 groups. [4]

4.1 Popularity of football in Poland

Football is the most popular sport in the world, including Poland. According to the statistics of "Sponsoring Monitor", the highest television viewing and attending live sports events reached that sport. 75% of respondents admitted to watching football on the TV, and 19% said they were participating in live events. Comparison to 3 most popular sports shows figure 1. [5]

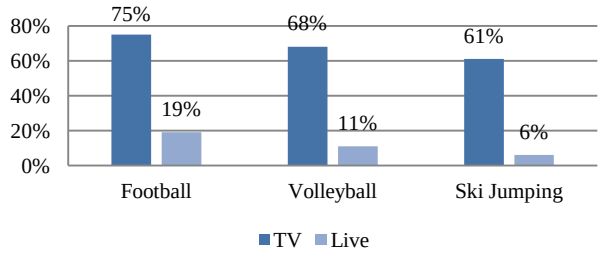

Figure 1: People watching sport on the TV or live by kind of sports in Poland

Football is very popular among young people as well. As figure 2 shows in season 2015/2016 794 648 youth players in Poland practiced sport in sports sections, of which 315 911 practiced football. [6]

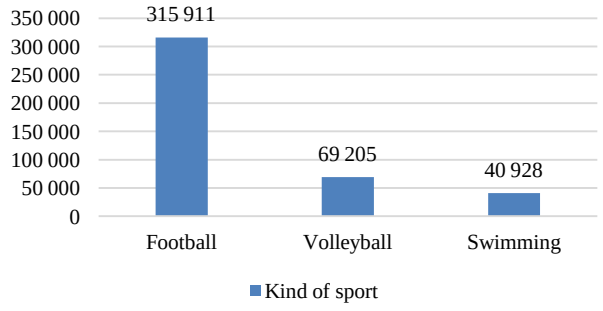

Figure 2: Number of youth sportsmen practicing sport in sports sections in Poland

4.2 Football in social network in Poland

It is also worth to mention that two of three the most popular sports fan pages on the popular social networking site belong to the Polish Football Association and a football club. The first place is taken by the Polish Football Association, whose page on Facebook was liked by over one million users. The next two places were taken by Legia Warszawa and the Polish Volleyball Association with the result of 651 and 355 thousand likes respectively. [7]

4.3 UEFA Euro 2012 in Poland

The organization of Euro 2012 in Poland and Ukraine proves the popularity of football in Poland. The tournament was 14th in the history of the European Championship. It took place in 4 cities in Poland and 4 cities in Ukraine. The organization of Euro 2012 attracted many fans who watched matches at stadiums, in fan zones or in front of the TV. [8]

4.4 Summary of football in Poland

In all of the analyzed factors regarding the popularity of sports, the significant advantage of football in comparison to other sports is extremely visible. This proves the position of football not only in sport, but also in Polish culture.

5. Football in Slovakia

Slovak Football Association was established in 1919 in Czecho-Slovakia. Slovakia has undergone several changes in the political system during almost another hundred years, what influenced names and structures of football association too. Nowadays it is for sponsorship reasons named Fortuna league. Top division includes 12 teams. The most famous are Slovan Bratislava, Spartak Trnava and in modern history MŠK Žilina.

5.1 Popularity of football in Slovakia

There is no significant interest for people of Slovakia to attend sports events in person. Following figure 3 shows average attendance per game of the three the most attended sports in Slovakia. Difference between attendance of football and ice hockey is only around 150. Third the most visited basketball is more than twice less attended than two the most popular. Sports like volleyball, handball etc. use to have less than 500 spectators. [9] [10] [11]

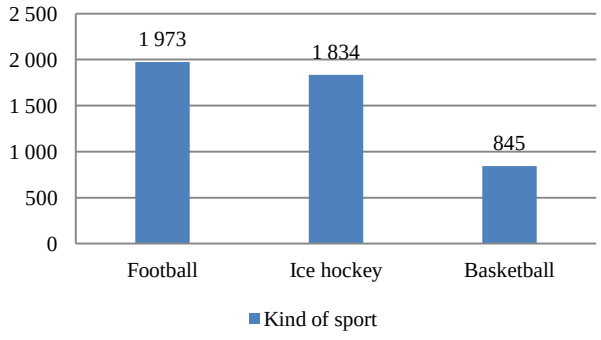

Figure 3: The most popular sports in Slovakia by attendance

Survey of GfK, Slovakia in 2015 was targeted on interest people in sport (TV, press, internet). It was considered only Slovak national leagues and national teams. Following figure shows three the most practiced sport in Slovakia. [12]

Similar like in attendance, there is no big difference between popularity of football and ice hockey. But watching Slovak ice hockey from home or pub is more popular than watching Slovak football. Cycling is third because of achievements of one of the most famous cyclist ever – Peter Sagan.

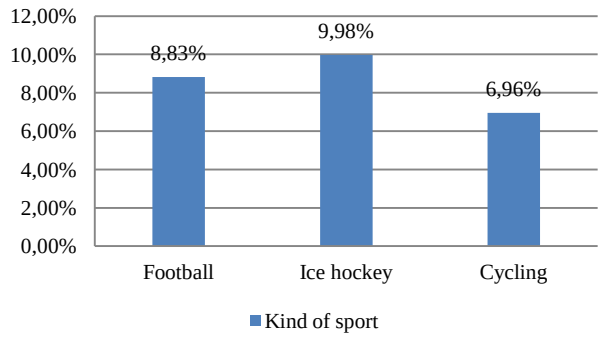

Figure 4: Most watched sports in Slovakia on the TV, press on internet

In season 2015/2016 in Slovakia 138 723 youth sportsmen practiced sport in sports sections. Following figure shows three the most practiced in Slovakia. Football practice almost 7 times more youth sportsmen, than second the most popular volleyball. In figures 3 and 4, which describe popularity of sports, values of factors were similar for both football and ice hockey. Significant difference in this figure is caused by costs of sports. [12]

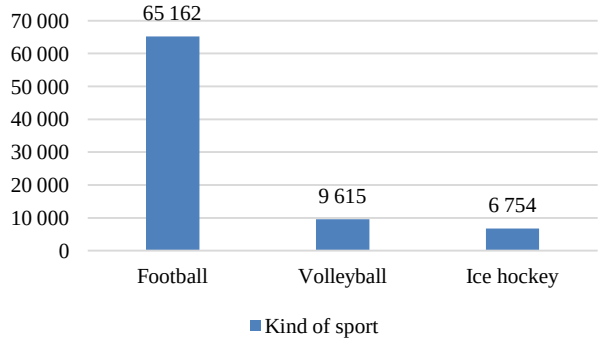

Figure 5: Number of youth sportsmen practicing sport in sports sections in Slovakia

5.2 Football in social network in Slovakia

Two the most popular sports fan pages on Facebook in Slovakia are about Ice hockey. First is with almost 128 thousand followers HC Slovan Bratislava and second with almost 104 thousand Slovak Ice Hockey Federation. Third the most like sports page is Slovak Football Federation. It is also important to note, that there are only ice hockey and football fan pages in TOP 20 the most liked sports fan pages on Facebook in Slovakia. [13]

5.3 2011 IIHF World Championship

Biggest international sports event hosted by Slovakia was 2011 IIHF World Championship played in Bratislava and Košice. Even after elimination of Slovakia in group stage, fans attended tournament till the end very well. Motto of championship was "Slovak Republic. Hockey Republic". Bratislava and Košice will be hosted cities in 2019 too.

5.4 Summary of football in Slovakia

Football does not have such a dominant position in Slovakia like in most of European countries. There are two similarly popular sports – football and ice hockey.

6. Revenues distribution of football clubs in Poland and Slovakia

As was written, there is difference between position of football in analyzed countries. It influences revenues distribution of top division football clubs too. In both countries is the largest part of revenues sponsorship/ commercial, but while in Poland it is only 43% in Slovakia up to 62%. Most significant difference is between revenues from domestic broadcasting. In Poland they are second highest revenues with 24% and in Slovakia last with only 2%. Figure 6 shows whole revenues distribution structure of Poland and Slovakia. [14]

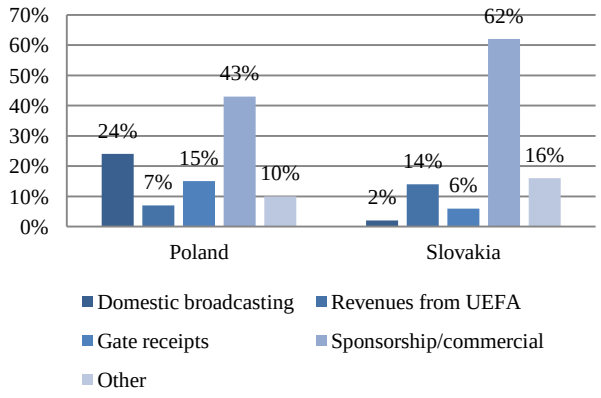

Figure 6: Revenue distribution of top division football clubs in Poland and Slovakia

7. Conclusions

Sports clubs are dependent on their revenues, because it directly affects, not only their results, but also their decision-making process and the overall existence. In football, the most popular sport of the planet, are revenues structure diversified more than in other sports. Percentage of individual factors of revenues distribution directly depends on the position of football in the country. Comparing Poland and Slovakia, the biggest difference is in the popularity of football. While in Poland football is the most popular sport, in Slovakia it shares the first place with ice hockey. This difference causes almost the opposite character of revenues distribution. With more interest of fans in Poland are revenues distribution more

focused on domestic broadcasting and gate receipts, whereas in Slovakia, because of lower popularity, more focused on sponsorship and revenue from UEFA. It is important to emphasize fact, that paper is about percentage of revenues, not about exact amount. It is assumed, that even a lower percentage of revenues from sponsorship in Poland are still more revenues in euros, than the higher percentage in Slovakia.

Acknowledgements
The paper was supported by the project VEGA 1/0617/16 - Diagnosis of Specifics and Determinants in Strategic Management of Sporting Organizations.

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ACQUIRER'S ACTIVITY OF POLISH PUBLICLY LISTED COMPANIES ON M&A MARKET BETWEEN 2004 AND 2016

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Abstract: *The author has analyzed mergers and acquisitions conducted by Polish public companies listed on main market in the years 2004-2016. Research was focused on Polish listed companies being on buy-side. The author excluded companies in the finance industry and companies with the Polish Treasury as a shareholder. Ultimately, almost 400 companies and above 1,000 M&A deals were analyzed for the purpose of this article. In the analysis, levels of activity were investigated quantitively, as the number of deals conducted by the companies under analysis, and qualitatively – as the share of companies engaged in M&A deals.*

Keywords: *mergers, acquisitions, activity, Poland, public*

1.1 Introduction

Public companies are seen as the most developed ones on most national capital markets. Listed companies are often the most developed and all of them are looking for any possibility to meet the expectations of their shareholders. In most cases, the primary expectation of public companies shareholders is an endless grow of the company they own. For the firms which are the biggest on the market, often functioning on a stable market with static or negative dynamic of growth, it is very difficult to show an increase in sales year on year. Trying to achieve this difficult objective, companies open branches abroad, develop new types of products or increase the scale of their remaining operations. In most cases, all of this can be achieved by organic growth. However, first it is not always possible and second – it takes time in most situations. That is why mergers and acquisitions are an inherent part of almost every stock exchange in the world. The objective of this article is to verify how many Polish public companies are active on the mergers and acquisition market and whether their willingness to take part in acquisitions as a buy-side is variable in time.

1.2 Establishment of the Warsaw Stock Exchange

Free market trade and capital market is a relatively modern phenomenon in the Polish economic system. Because of political changes, Poland became a new liberal market on the map of Europe in 1989. Polish businesses became private and ever since have been trying to catch up with West European markets. In the beginning, national companies were subject to the privatization process, which was the first step in establishing the Polish capital market. The needs of Polish capital market stakeholders were increasing, which led to the establishment in April 1991 of the Warsaw Stock Exchange. At the same time, a lot of foreign investors came to Poland to make a profit on the new market with a high potential. That was the time when the first M&A processes started in Poland.

1.3 Mergers and acquisitions theory

Corporate takeovers in most cases are the largest investments in a company's existence [1]. Even if we deal with a public company, a bad decision in this area can be problematic. A lot of papers claim that mergers are not very efficient processes for companies and most of bids are too high to create enough synergy. Fu, Lin and Officer [2] proofed that overvalued firms in most cases cannot create a value for their shareholders. What is more, acquirers' CEOs are very likely to reward themselves for these inaccurate investments. A similar conclusion emerges from a paper published by Lin, Chou and Cheng [4]. Bertand and Betschinger tested the performance of domestic and cross-border acquisitions made by Russian companies and showed that Russian acquirers show a worse performance than non-acquiring firms [8].

On the other hand, there are examples that prove the effectiveness of acquisitions. Morresi and Pezzi [3] analyzed market reactions to announcements about high-equity international acquisitions made by medium-size listed companies from Italy and demonstrated a positive reaction on the part of investors. Bhagat, Dong, Hirshleifer and Noah [7] claim that the methods of measuring the success of acquisitions by other scientists underestimated the real value creation of such deals.

Taking into consideration the fact that acquisitions are risky and a lot of research claims that M&A processes do not often have a positive influence on corporate effectiveness and stock prices, it is important to estimate how many Polish public companies are likely to risk and create their value by taking part in acquisitions rather than just grow organically.

2.1 Research methodology

The selection of companies to be analyzed began with the choice of companies listed on the main market of the Warsaw Stock Exchange (WSE) on 30 November 2017.

The companies excluded from the group selected were as follows:

- The Polish Treasury was the principal shareholder.
- Represented the financial sector (banks, investment companies, insurance companies, etc.).

Table 1 shows the process of companies selection.

Table 1 Process of selecting companies

Filter	*Companies matching filter*	*Number of companies after selection*
Companies floated on WSE main market	478	478
Companies without national treasury shareholder	460	460
Companies from non-financial sector	409	394

Ultimately, 394 companies were chosen. The data about shareholders and the business profile of companies was collected from the *Notoria* database, which gathers data of all Polish public companies. When data about the shareholders were missing, they were supplemented by companies' periodic reports.

Information about M&A transactions was downloaded from the Thomson Eikon database, a global, professional database of capital market transactions including mergers and acquisitions, private and public deals. In the first step, 6,598 transactions from the Polish capital market were chosen. In the process of inquiry, the author chose only transactions marked as completed. Then the author chose transactions applied to selected companies. For the purpose of the study, all transactions made by the mother company and subsidiaries (excluding related entities transactions) where taken under consideration. In the next step, the author selected transactions where companies from the analyzed group were on the buy-side and excluded all transactions completed before 2004 and after 2016. In the end, all transactions where the object of transaction was less than 10.0% of shares were excluded. The 10.0% shares acquired in the transactions is commonly mentioned by a lot of sources as a cut-off between portfolio investment and acquisition of a minority share in a company [5]. A similar definition of the difference between portfolio investments and direct foreign investments is provided by the Organization of Economic Co-operation and Development [6]. The process of transactions selections is shown in the table below:

Table 2 Process of transactions selection

Filter	*Number of selected transactions*
Records applied to selected companies with completed status	1034
Records where buy-side was a company from the analyzed group or its subsidiary (excluding related entities transactions)	586
Records where transaction was completed in the years 2004-2016	531
Records where no less than 10.0% of shares was acquired	498

2.2 Limitations of the research

The main problem in the analysis of M&A processes is the low percentage of disclosure deals. Private companies in Poland are not obligated to disclose their deals conducted on the private market. This is the main reason why the author decided to concentrate on the analysis of the activities of public companies on the M&A market. Polish public companies have to publish information about most of their activities in this area. This obligation of Polish public companies sharply increased the probability of including the fact of a transaction in the Thomson Eikon M&A database, which is used in this research.

Because there is less company-years observations in the beginning of analyzed period (as a consequence of analyzing companies floated on WSE at a particular time) the author waived to analyze results as absolute figures. The conclusions were based on the relative share of buy-side companies and on the number of deals in the analyzed group. For research purposes, the author used a two-way approach in measuring the activity level:

- quantitative approach – the number of transactions for every company in the analyzed group,
- qualitative approach – the percentage of companies on the buy-side in any transaction in the analyzed period.

All statistics will be aggregated for the entire period under analysis and yearly, for every year from the analyzed period.

3.1 Results – aggregated results

In the period under analysis, the companies scrutinized took part in 498 M&A transactions.

Table 3: Deals completed by analyzed companies

Number of companies	*Number of transactions*	*Number of transactions for every company*
394	498	1.26

In the period under analysis, every company from the selected group had an average of 1.34 transactions. More information can be obtained from the analysis of the percentage of companies which took part in any transaction between 2004 and 2016. Th group analyzed included 163 such companies.

Table 4 Number of companies active as the buy-side in the analyzed period

Number of companies	*Number of active companies*	*% of active companies*	*Average for active companies*
394	168	42.6%	2.96

Analyzing the table above, it is possible to anticipate that about 43.9% of listed companies were active on the M&A market and they made an average of 2.96 transactions.

3.2 Results – annual analysis

Answering the question if there is any difference in the activity of public companies on the M&A market, it is very important to take a look at the annual activity for entities from the tested group. As the denominator in this analysis, the author decided to take only the quantity of companies which were listed on the WSE in a given year. In the author's opinion, such an approach increases the comparability of results. The figure below shows the quantity of company-year observations.

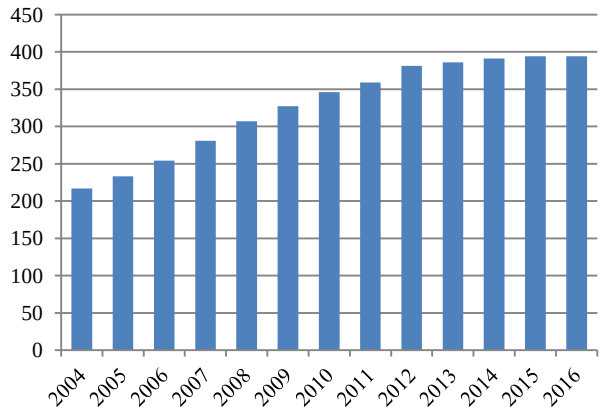

Figure 1: Number of companies analyzed in years 2004-2016.

Seeing Figure 1, it is noticeable that the number of analyzed companies increases with time by the number identified for the needs of the research. Figure 2 shows the number of deals completed in the analyzed years by tested companies and the average number of deals for every company analyzed in a given year.

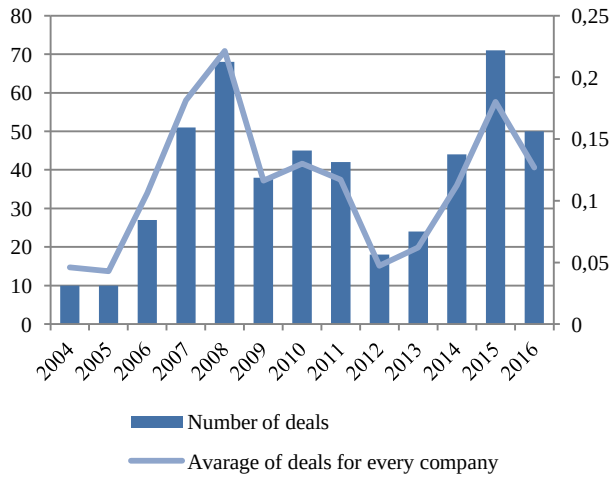

Figure 2: Number of deals competed by analyzed companies in years 2004-2016

It is noticeable that Polish public companies were more likely to acquire other companies in the years around 2008 and 2015. A substantial number of deals was also observed around 2011. To complete the present analysis, it is crucial to show statistics about the percentage of companies which completed any acquisition in one year. Figure 3 shows such statistics:

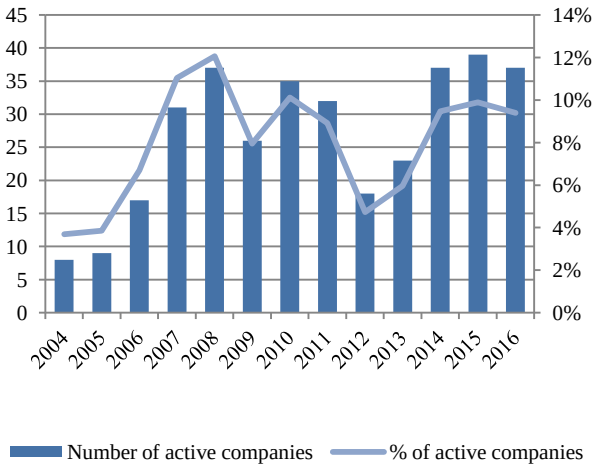

Figure 3: Number of active companies as the buy-side in years 2004-2016

Analysis of Figures 2 and 3 demonstrates that the moments of high level of M&A activity of public companies might be related to the economic situation. Higher than average activity levels were noticed in the years close to 2008, i.e. the time of the mortgage crisis, and around 2011 – the time of the Euro crisis. This observation could be the subject of further researches.

4. Conclusions

The activity of the analyzed Polish publicly listed companies on the M&A market was variable in time. In the whole analyzed period, almost half of the companies completed at least one acquisition. Given that the analysis excluded companies from the financial sector, which are often the most active on the M&A market, the figures show that Polish public companies are active on the M&A market. For further research, it would be worthwhile to compare the M&A activity of Polish public companies to that of listed companies from other countries. Another area to analyze would be to test if M&A activity is negatively correlated with the status of the financial market.

Acknowledgement

Project financed from the grant of Poland's National Centre for Science under decision no. DEC-2013/11/B/HS4/00695.

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IMMIGRANTS ON LABOUR MARKET IN POLAND

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Abstract: *Since the Poland's accession to the European Union, citizens of other countries have been showing increasing interest in the Polish labour market. They work in different sectors of the economy as cheap workforce. The condition of the Polish labour market is improving, therefore foreigners are more willing to take up employment in Poland. The main aim of the article is to characterize the labour market, especially including labour migration of foreign employees. The topic is only an outline and starting point for future research on migration processes in Poland. As a result of research, it turned out that the low unemployment and greater avaliability of new places have a influence on the growing foreign immigration. Moreover, the Polish labour market is more attractive for people from Ukraine and the other neighbouring countries.*

Keywords: *labour market, immigrants, labour immigration, foreigners*

1. Introduction

Employment immigration is becoming more and more important in the European countries, especially those affected by the problem of population aging [1]. Poland is a place where people immigrate from Eastern Europe and conflict zones [2]. The aim of the article is to characterize the Polish labour market, especially including labour migration of foreign employees. The issue raised in the article is only an outline and starting point for future research on labour migration processes to Poland. The information in this article on the number and structure of work permits and declarations on entrusting work to a foreigner can illustrate actual situation of foreigners on the Polish labour market.

Forecasts indicate that the scale of the inflow of immigrants to Europe will increase in the coming years, and Poland may become an emigration and immigration country [3]. The main source of data are statistics on the number of the issued work permits, registered declarations of intent to entrust work to a foreigner available on the website of the Ministry of Labour and Social Policy as well as statistics on migration and migrant populations available on the Eurostat website [4] [5].

2. Employment and unemployment in the labour market in Poland

The labour market is a place where transactions of the buying and selling of workforce take place. The demand for work is reported by the employer, and the sales process concerns the qualifications, skills, experience, education and knowledge of employees [6]. Work is defined as the purposeful activity of people who, by using work tools, adapt the subject of work to their needs (social, spiritual, material and others) [7]. Employment is a specific form of work for others in return for salary [8]. According to the data of the Central Statistical Office, the number of jobs created in 2015-2017 exceeded the number of lost jobs.

In 2015, 601.9 thousand new jobs were created in Poland, and 317.6 thousand were liquidated. In 2017, 12.2% (75.4 thousand) more jobs were created compared to 2016. From year to year, the difference between new created jobs and liquidated jobs increases, which means that more and more employees are needed on the labour market.

Table 1 Jobs created and lost in Poland over the 2015-2017 period (thousand)

Specification	*2015*	*2016*	*2017*
Number of jobs created	601,9	618,8	694,2
Number of jobs lost	317,6	284,2	264,2
Balance	+ 284,3	+334,6	+ 430,0

Source: own study based on the GUS

In Poland, the number of employees in 2015-2017 increased from year to year. In 2015, there were almost 14.5 million employees, and in 2016 their number increased about 14.96 million (an increase of 3%). In 2017, the number of employed persons increase and, at the same time, the number of unemployed was lower than in the previous year (table 2).

Table 2 Employees and Unemployment in Poland in 2012-2016 (thousand)

Specification	*2015*	*2016*	*2017*
Employees	14 504	14 964	15 720
Unemployment	1 563,3	1 335,2	1 081,7

Source: own study based on the GUS

Negative impact on the Polish labour market has a demographic trend that reveals an aging population and the outflow of the working age population. It is a factor that makes employers look for a foreign workforce. According to data obtained from the Ministry of Family, Labour and

Social Policy, in recent years there has been a significant increase in the number of registered declarations about the intention to employ a foreigner, especially with regard to citizens of countries neighbouring Poland from the east.

3. Legal aspects of foreigners' access to the Polish labour market

After the Polish accession to the EU, there have been a number of changes in the policy of employing foreigners in Poland, due to which foreigners have obtained easier access to the Polish labour market. In the light of the current regulations, a large number of citizens of the European Union countries do not need work permits. Citizens of some former USSR countries (Ukrainians, Belarusians, Russians, Moldovans and Georgians) are also exempt from the obligation to obtain a work permit. [9]. In 2014, next facilitations were introduced for foreigners wishing to work in Poland, among others: simplified licensing procedures for persons continuing employment, as well as reduced costs related to the issue of a work permit. Currently, foreigners can obtain a work permit in Poland for a period not longer than three years with the possibility of extending it in five types of employment. Type A - applies to a foreigner who performs work on the basis of a contract with an employer whose registered office is located on the territory of Poland. The other four types of permits (from B to E) concern foreigners who are management staff, advisors and experts who work with foreign employers [11].

As of January 1, 2018, further changes were introduced in the regulations regarding economic immigrants taking up employment in Poland. In accordance with applicable law, an employer must obtain appropriate permits to employ a foreigner. This may be, for example, a seasonal work permit or an entry in the records of statements with information on entrusting work to a foreigner. An important issue is the conclusion of a contract that must be translated into a language that will be understandable for the person being employed. The employer is obliged to copy the documents related to the stay of the foreigner in Poland and to submit his/her application for social security (if it results from the form of employment offered). In addition, the employer as an entity that entrusts work has a tax obligation, which means that he must calculate, collect and pay income tax advances. According to the simplified procedure, which allows the employment of employees from one of the 6 indicated countries (the Republic of Armenia, the Republic of Belarus, the Republic of Georgia, the Republic of Moldova, the Russian Federation and Ukraine) they can work in Poland for a period of 6 months over a period of 12 consecutive months. The condition for using the simplified procedure is to obtain an entry in the register of declarations in the employment office, as well as to have a document confirming the residence permit by a foreigner in Poland, being the right to work on the territory of the Republic of Poland. The main provision changing from January 1, 2018, the current law is the employer's obligation to inform the Labour Office about the actual start of work by a foreigner on the day of starting work. An important issue is the provision stating that a foreigner may only work for the employer who was indicated in the permit or statement. He can do it while waiting for a seasonal work permit, but according to the information contained in the documents. [10].

4. Labour immigrants on the labour market in Poland

In 2016-2017, the number of labour migrants on the Polish labour market increased almost twice. Men are more willing to work in Poland than women. In 2017, 197.6 thousand men and 69.5 thousand women were recorded on the Polish labour market (Figure 1)

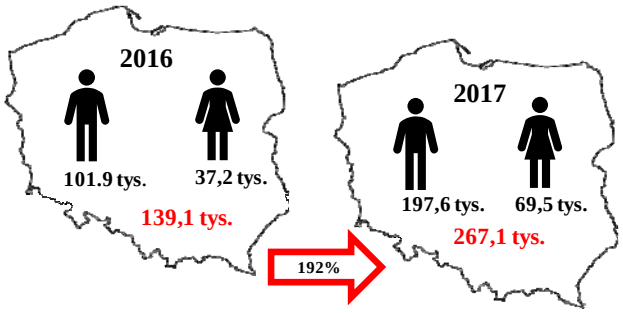

Figure 1: Number of immigrants with a work permit in Poland in 2016-2017

In the analysed years, the largest number of A-type work permits were issued to foreigners. From 2015 to 2017, their number increased by 167,644. In the case of other types, their number is also growing, but they are not as big changes as in the case of type A The type B licenses (from 0.14 to 0.48%) had a negligible share in the total number of issued permits in the audited period.

Table 3 Permits for work according to types granted to foreigners in 2015-2017

Specification	*2015*	*2016*	*2017*
Type A	61056	121872	228700
Type B	315	312	339
Type C	3356	3962	4459
Type D	502	455	934
Type E	557	793	1194

Source: own study based on the MRiPS

Table 4 presents the breakdown of the issued work permits according to different branches of NACE (Nomenclature statistique des Activités économiques dans la Communauté Européenne). The largest number of permits granted concerns employees employed in the construction, transport and storage, as well as in manufacturing. In case of other branches, an increase in the number of employees was also noted. Considering employment in professional, scientific and technical activity from 2015 to 2017, there was an increase in the number of employees by 14.2 thousand people. This means that professionals in the Polish labour market are looking for skills and employees who care about their development. The total number of permits issued in the analyzed years increased by 169 840

and in the longer term it is forecast that this upward trend will continue. The Polish labour market is interesting for foreigners.

Table 4 Work permits issued to foreigners according to selected sections of the NACE in 2015-2017

Specification	*2015*	*2016*	*2017*
agriculture, forestry, hunting and fishing	3178	4506	6391
industrial processing	4588	6202	24991
architecture	12911	24423	46510
wholesale and retail trade	5570	8138	13570
transport and storage	7957	17819	32781
activities related to accommodation and food services	2576	4387	8929
information and communication	1712	2934	4052
financial and insurance activities	336	391	615
professional, scientific and technical activities	3322	12073	17488
education	303	414	837
health care and social assistance	247	408	797
households employing employees	7585	10541	8941
Total	65786	127394	235626

Source: own study based on the MRiPS

Taking into account the positions on which foreigners are most often employed, it should be noted that according to employee groups, foreigners are most often employed as skilled workers, employees with simple jobs as well as management, advisors and experts (table 5). Most employees are employed as skilled workers, in the case of this group from 2015 to 2017 an increase of 128 637 (18.16%) was noted. According to the Ministry of Family, Labour and Spcial Policys, foreigners were most often employed in IT or teaching education.

Table 5 Work permits issued to foreigners by selected groups of employees in 2015-2017

Year	*Accordings employee groups*			*According groups of professions*				
	managers	*skilled workers*	*employees at simple jobs*	*IT specialists*	*lowers*	*artistic professions*	*Medical professions*	*teaching professions*
2015	3592	28555	15039	1579	18	239	596	426
2016	5141	51891	30750	2752	17	291	636	462
2017	11776	157192	66624	3833	29	422	711	523

Source: own study based on the MRiPS

The number of declarations of intention to entrust work to a foreigner in the years 2015 - 2017 is characterized by an upward trend. During the surveyed period men were most willingly employed (over 65% of declared claims), however, within three years the share of working women was gradually increasing (from 33.7% in 2015 to 35.0% in 2017). The predominance of men may be primarily due to the specificity of the work that employers can offer to foreign employees and the fact that a man is the head of the family and most often looks for better employment (Figure 2).

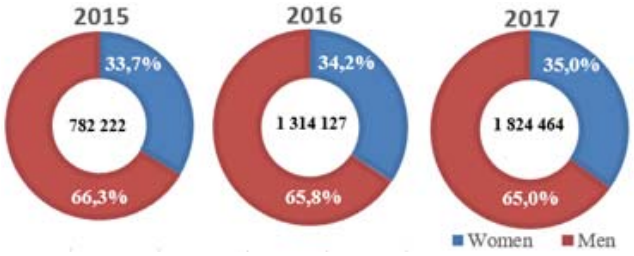

Figure 2 Number of declarations of intention to entrust work to a foreigner in 2015-2017

Source: own study based on the MRiPS

According to employers' statements on the intention to entrust work to a foreigner and taking into account the citizenship of immigrants in the analyzed years, citizens of Ukraine (UA), Georgia (GE), Belarus (BY) and Russia (RU) are most willing to be employed. Employees from these countries are most willingly accepted by employers.

Table 6 Declaration on the intention to entrust work to a foreigner according to citizenship of immigrants in 2015-2017

Year	*Citizenship*						*Total*
	BY	*RU*	*UA*	*MD*	*GE*	*AM*	
2015	5599	1939	762700	9575	1366	1043	782222
2016	23400	3937	1262845	20650	1698	1597	1314127
2017	58046	6150	1714891	31465	11126	2786	1824464

Source: own study based on the MRiPS

Studies have shown that the majority of economic migrants were employed as skilled workers. On the one hand, this may suggest that foreigners have better qualifications than Poles, but on the other hand, the migrating population consists mainly of the unemployed.

5. Conclusions

Migration flows have changed in nature, intensity and geographic location over recent years. They affect the situation of both the country of origin and the destination country. Stopping these flows would be pointless because they are usually encouraged by economic factors [12]. The accession of Poland to the European Union resulted in the opening of the labour market to immigrants. In addition, the changes introduced in 2014 and 2018 in Polish law simplified the procedure for employing foreigners, which in turn has directly influenced the increase in economic immigration. In the years 2015-2017, the number of work permits issued has been systematically growing. In 2017, there was an increase in the number of economic migrants by nearly 200%. Most permits were issued in the construction, transport and storage. The most immigrants are qualified workers. According to the statistics, the

largest number of economic immigrants are the citizens of Ukraine. In the following years, an even greater increase in labour immigration in Poland is forecasted. The largest inflow of workers is expected from Eastern Europe.

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THE ANALYSIS OF COMPANIES OF THE FUEL SECTOR BASED ON THE EXAMPLE OF COMPANIES QUOTED ON THE WARSAW STOCK EXCHANGE IN POLAND AND THEIR FAIR VALUE BETWEEN 2008-2018

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Abstract: *This paper examines share price of the companies listed on the WIG-FUEL and their fair value between 2008-2018. Data from 2008 to 2018 were collected from the Stooq.pl (Polish portal of shares). Two hypotheses are tested: (1) value of the shares based on the market price; (2) value of the shares as the fair value of shares. The fuel market was analysed and characterised, also the companies participating in it were described. Nevertheless, the market value of shares does not reflect the fair value of the shares which is currently assigned to different companies in the sector. The research analysed the key financial ratios, the actual value of shares; also the fair value of the fuel sector companies listed on the Warsaw Stock Exchange was calculated.*

Keywords: *fuel sector, fair value of shares, financial condition, profitability, fuel prices.*

1. Introduction

The fuel market in Poland is developing and operating very well, and fuel concerns such as PKN ORLEN even extend beyond the borders of the country. It should be noted that along with the sale of fuel, the fuel concerns earn much money, and even after the depreciation, they earn more than average and have a very high rate of return. The Polish fuel market is consolidating and according to it, the share of five grand fuel concerns, including PKN Orlen and Lotos and three foreign ones, is growing. The number of single petrol stations is decreasing, cheap stations located at supermarkets are disappearing. The beginning of 2014 brought surprisingly good results of retail segments of large Polish fuel companies.

Evaluation of shares allows to some extent for determining the company's value as a share value does not depend exclusively on demand and supply on the market, but also on many factors which shape its rate starting from valuation of an enterprise by means of different methods up to showing the mechanisms changing the share value in a way increasing its value or underrating it. Therefore, valuation of shares and estimation of their fair value is extremely important. This must be done in an objective manner. Repeatedly, the value of shares listed on WIG20 of the Stock Exchange is distorted and underrated, which is connected with an incorrect valuation of an enterprise's value listed on the Warsaw Stock Exchange. The research concerns the determination of fair value of shares listed on the index of WIG20 when analyzing simultaneously chosen rates of particular companies from WIG20. The value of enterprises listed on this index was checked for proper determination of their fair value as currently their values appears to be underrated.

2. Fair value of listed companies

Share price of the companies listed on the Stock Exchange should reflect also their fair value. The fair value can be defined in several ways. In view of the foregoing, the fair value is a value used repeatedly in accounting, and thus in Article 28 (6) of the Accounting Act of 29.09.1994 as "the amount for which a given asset component could be exchanged, and the liability could be paid on market transaction terms between interested and well-informed, unrelated parties.

In view of whether the price of shares that are quoted on the stock exchange corresponds to their fair value, should be found in the value alone, since, after all, the values may be diverse, like the value of a similar company, producing similar goods and operating in the same industry, will also be diverse for various reasons.

The subject of trade covers minority shares, and the main market participants are retail investors or minority institutional investors, thus the price of shares should reflect the fair value characterizing the liquid minority interest [12].

The value presented in this way seems righteous, which is confirmed by the premium paid by the investors who announce calls for subscription for shares and plan in this way the purchase of the controlling interest. Then the premium reflects the difference between the level of liquid minority interest and the level of controlling interest. Sometimes the level takes into account benefits resulting from synergy. An investor purchasing the controlling interest in this way receives premiums that appear after taking over control of a company, in the form of funds, business management and making a number of strategic decisions.

The fair value of the share price should be determined in accordance with the idea of capital market, namely the market participants should have equal access to data, information and all messages concerning a given company [13, 14]. However, the investors are divided into three groups:

a) People with access to the most closely guarded information that affects the price and the business value, namely those can the company's management board or shareholders,
b) Institutional investors with blocks of shares with simultaneous access to the company's management board,
c) Individual investors who have access to public information.

There is one premise more to determine the fair value of share price. The investors are fond of investing in shares, namely they buy them as in the past they managed to earn on them and they feel that presently the share price is ideal and reflects their fair value and will enable them to obtain fair dividend in the future [1, 2].

Such a purchase or sale of shares can largely overestimate or underestimate the share value of a quoted company. Here the chemical industry may serve as an example, namely shares in chemical companies at the beginning of the new millennium, when shares in these companies were being purchased without any analysis in technical terms, but looking at their name and value, which was increasing overnight. In view of the foregoing, this led to excessively high business value above its fair value.

The share price should thus reflect the fair value of a company listed on the Warsaw Stock Exchange. For the value of these companies be fair, the market must make available to all investors information regarding companies listed on the Warsaw Stock Exchange. The shareholders should be treated equally; therefore we cannot distinguish majority shareholders as those who should have information unavailable for minority shareholders. First of all, shares should be liquid securities, therefore they should be in free float and have real-time transferability, namely at any moment and at any time during the office hours of the Warsaw Stock Exchange on a business day [3].

3. Fuel market in Poland

PKN ORLEN and LOTOS are one of the largest fuel concerns in Poland. They are quoted on the Warsaw Stock Exchange, where they are valued in terms of market activity and the potential rate of return from the funds paid by the investors.

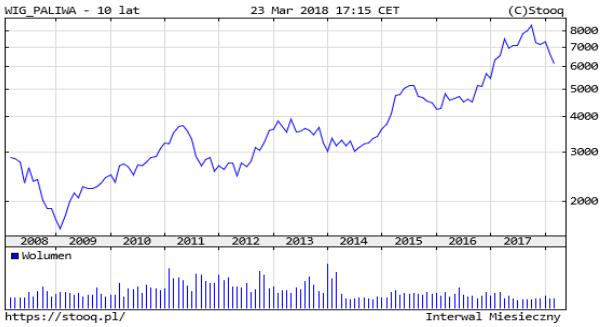

Figure 1: WIG-PALIWA in the period from 03.2008 to 03.2018 [15, 16].

However, as far as the companies quoted on the Warsaw Stock Exchange in Poland are concerned, it should be noted that they are undervalued because they only follow the WIG-PALIWA index. Moreover, due to the fact that from 2008 their value, in the majority of cases, recovered the maximum value of 2008, thus, especially according to the calculations and conducted studies, it was found that the fair value of the fuel sector companies was impossible to achieve before 2016.

The WIG-PALIWA (WIG-FUEL) index presented in Figure 1 shows that since 2014, the fuel sector companies in Poland have revealed changes and upward trend within their values. It is possible to claim that their value does not reflect the market value and fair value. After 2018, we hope that will be better *(data of the stooq.pl).*

Nevertheless, with such a volatile market and the noticed good moods of investors, it will be possible to achieve the reported maximum and also fair value of the fuel sector companies.

4. Analysis and valuation of the WIG-PALIWA sector's companies quoted on the Warsaw Stock Exchange (WSE) in Poland

Within the fuel sector, one company, which reported its maximum value on 23.03.2018, can be distinguished, and this is PKNORLEN [4, 8].

The remaining companies did not have its maximum or even fair value, though they can show the net profit and good financial condition. On the other hand, some companies were overvalued by more than 50%.

Table 1 The Fuel sector's companies quoted on the Warsaw Stock Exchange in Poland as of 23.03.2018 (own development based on the data of the Warsaw Stock Exchange)

Name	*Average rating*	*rating*
LOTOS	5.0/5.0	A
MOL	4.0/5.0	BB-
PGNIG	4.5/5.0	AAA
PKNORLEN	5.0/5.0	AAA
SERINUS	2.0/5.0	D
UNIMOT	4.0/5.0	BBB+

These companies are MOL, PGNIG, SERINUS and UNIMOT. Only PKN ORLEN and LOTOS is trying to stay ahead and regain its value from the last years (Table 1-2).

Table 2 The Fuel sector's companies quoted on the Warsaw Stock Exchange in Poland as of 23.03.2018 (own development based on the data of the Warsaw Stock Exchange)

Name	*Current price PLN*	*Maximum price PLN from the beginning of the stock exchange quotation*
LOTOS	55.18	68.85
MOL	39.38	45.81
PGNIG	5.90	6.98
PKNORLEN	86.00	134.45
SERINUS	0.99	1.38
UNIMOT	18.95	49.59

Tables 3-4 presents the key ratios that show the financial condition of the fuel sector companies. Within the seven examined companies, the generated profit per share was reported in 5 companies. It shows that the fuel companies prosper properly on the financial market and are able to record higher or lower profits [10].

The price to the operating earnings ratio shows losses of the company and this state of affairs was reported in one stock exchange quoted companies – SERINUS, but MOL generated a nearly double-digit ratio (risk) and LOTOS, PGNIG, PKNORLEN and UNIMOT digit ratio (risk).

Table 3 Technical evaluation of the Fuel sector's companies quoted on the Warsaw Stock Exchange in Poland as of 31.12.2017 (own development based on the financial data of the of the Warsaw Stock Exchange)

Name	*P/OE (price/ operating earnings)*	*P/BV (price/ book value)*
LOTOS	4.58	0.95
MOL	13.98	1.05
PGNIG	8.90	1.04
PKNORLEN	4.25	1.04
SERINUS	-1.20	1.62
UNIMOT	3.48	0.77

In contrast, analysing P/BV and P/P, it should be noted that both the price to the book value and the price to profit demonstrate that two companies exemplary operate on the market and have a value of about 1.0 [9], and these are SERINUS and PGNIG.

Other companies do not significantly differ from the average values, and these are LOTOS, MOL and PKNORLEN.

Tables 5-6 presents the studies concerning, among others, the net profit, depreciation, EBITDA and assets of the fuel sector companies.

Table 4 Technical evaluation of the Fuel sector's companies quoted on the Warsaw Stock Exchange in Poland as of 31.12.2017 (own development based on the financial data of the Warsaw Stock Exchange)

Name	*P/P (price/ profit)*	*Profit per share*
LOTOS	0.42	2.622
MOL	0.47	93.488 (HUF)
PGNIG	0.97	0.079
PKNORLEN	0.39	3.720
SERINUS	1.55	-0.064
UNIMOT	0.05	1.329

According to the obtained values, it is clear that only SERINIUS showed a loss, which was confirmed by the previous ratios included in Table 3. Other companies have shown a substantial profit which was generated in 2017.

Table 5 Technical evaluation of the Fuel sector's companies quoted on the Warsaw Stock Exchange in Poland as of 31.12.2017 (own development based on the financial data of the Warsaw Stock Exchange)

Name	*Net profit (net loss) in thousands PLN*	*Depreciation in thousands PLN*
LOTOS	484711	204878
MOL	76607000 (HUF)	102834000 (HUF)
PGNIG	458000	673000
PKNORLEN	1591000	662000
SERINUS	-9681	487
UNIMOT	10671	1256

Other companies have shown a substantial profit which was generated in 2015.

Table 6 Technical evaluation of the Fuel sector's companies quoted on the Warsaw Stock Exchange in Poland as of 31.12.2017 (own development based on the financial data of the companies quoted on the Warsaw Stock Exchange in Poland)

Name	*EBITDA in thousands PLN*	*Assets in thousands PLN*
LOTOS	927504	21171200
MOL	164680000 (HUF)	2147483647 (HUF)
PGNIG	1323000	48203000
PKNORLEN	2649000	60664000
SERINUS	-988	114971
UNIMOT	15825	512410

The book value per share presents that the companies are overvalued, and these are LOTOS, MOL, PGNIG, PKN ORLEN, and UNIMOT in the case of one companies, such as SERINUS, undervalued.

However, it is important not to follow this opinion because the values are only the book values, and the calculation of them is purely mathematical and financial. In the case of using the economic attitude and interpretation [5], it would occur that the companies do not have the fair value (Table 7) [7, 11].

Table 7 The Fuel sector's companies quoted on the Warsaw Stock Exchange in Poland as of 31.12.2017 (own development based on the data of the Warsaw Stock Exchange)

Name	*Book value per share in PLN*
LOTOS	57.945
MOL	2124.593 (HUF)
PGNIG	5.819
PKNORLEN	75.278
SERINUS	0.025
UNIMOT	23.914

The profitability of the equity as well as the profitability of assets is shown only by LOTOS, MOL, PGNIG, PKN ORLEN and UNIMOT, however, SERINUS do not have it. Therefore, according to the presented study, it is possible to observe that the fuel concerns have the profitability and they are not threatened by any disturbance of the financial liquidity (Table 8).

Table 8 The Fuel sector's companies quoted on the Warsaw Stock Exchange in Poland as of 31.12.2017 (own development based on the data of the Warsaw Stock Exchange)

Name	*ROE*	*ROA*
LOTOS	19.41%	8.65%
MOL	14.86%	6.63%
PGNIG	9.12%	5.88%
PKNORLEN	24.49%	12.91%
SERINUS	-468.92%	-16.77%
UNIMOT	25.09%	3.99%

Currently, the value of companies significantly deviates from the maximum value achieved a few years ago. The only one exception is PGNIG, which achieved the maximum value in its history [7, 6, 8, 9]. Other companies have the value less than 40% of the maximum one - Table 9.

Table 9 The Fuel sector's companies quoted on the Warsaw Stock Exchange in Poland as of 23.03.2018 (own development based on the data of the Warsaw Stock Exchange)

Name	*Current value*	*Maximum value*
LOTOS	55.18	68.85
MOL	39.38	45.81
PGNIG	5.90	6.98
PKNORLEN	86.00	134.45
SERINUS	0.99	1.38
UNIMOT	18.95	49.59

However, the fair value which should be reflected by the share prices of the examined companies significantly differs from the calculated value [ ], which was presented in Table 7. In some cases, it is even 40% of the current value.

However, the fair value is considerable higher than the current value of the examined companies, and only similar in one company, PGNIG.

Table 10 The Fuel sector's companies quoted on the Warsaw Stock Exchange in Poland as of 23.03.2018 (own development based on the data of the Warsaw Stock Exchange)

Name	*Fair value*	*Deviation from the fair value in PLN*
LOTOS	65.00	9.82
MOL	40.50	1.12
PGNIG	6.20	0.30
PKNORLEN	115.90	29.90
SERINUS	1.10	0.11
UNIMOT	24.80	5.85

Deviation from the fair value in PLN = DevFV
DevFV = Fair value - current value (table 10).

5. Conclusion

The share price of the fuel sector companies quoted on the Warsaw Stock Exchange in Poland is significantly underestimated by the current financial situation in the world [3]. Nevertheless, fuel companies should demonstrate the higher value and at least the fair value because fuel prices are stabilized, and their profits indicate good financial condition, especially within grand fuel concerns, such as PKN ORLEN, LOTOS and PGNIG. The value of the fuel sector companies should be valued because the companies have the majority of assets expressed in the fuel supplies.

Fuel companies earn money because they largely focus on the fuel sale as well as the increase or decrease of the sale price. Therefore, the constantly kept stores result in the profit growth and sometimes the decrease of profit together with the price which is liquid and reflects their current assets. However, they achieve huge profits which was confirmed in the studies of ratios in the last few years and the book value per share studies in 2018.

The fair value of the fuel sector companies quoted on the Warsaw Stock Exchange in Poland should be achieved within two years, until 2020, with the improvement of situation on the Global financial markets.

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FORECASTING CORRECTNESS OF INCURRING CREDIT WITH THE AID OF E.I. ALTMAN'S, J. GAJDKA'S AND D. STOS'S DISCRIMINANT ANALYSIS MODELS ON THE EXAMPLE OF 200 STUDIED COMPANIES FROM OPOLE AND LUBUSKIE PROVINCES

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Abstract: *The credit risk related to issuing credit for a company is mostly the result of too high amount of the incurred credit, wrong prediction of future periods and repayment of the incurred liability. In order to minimize risk, as part of information about a credited company, there should be technical and economical information enabling to conduct "collective evaluation of the company's activity" with the use of E.I. Altman's, J. Gajdka's and D. Stos's models. Both models were used in the group of the studied companies of Opole and Lubuskie provinces. The research showed that incurred credit contributed to improvement of the financial liquidity in both groups. However, credits of greater worth led to the lessened increase of net profit and contributed to the small decrease of companies showing net loss. On the other hand, the group of companies, in which credits of lower worth were incurred, could decrease the number of companies suffering from net loss.*

Keywords: *company, financial liquidity, credit, discriminant analysis, net profit*

1. Introduction

Using the J. Gajdka's and D. Stos's model in practice, it should be noted that the model proves to be perfect for Polish conditions because it reflects the realities of the Polish market, and demonstrates correctness of incurred credit of studied companies. The E.I. Altman's model was also used in research because the research results had to be compared in terms of a difference from the Polish market because this ratio was created for the American market and its needs.

200 micro, small and medium-sized companies were studied in the research, including 100 companies from the Opole province and 100 companies from the Lubuskie province. Such a big group of the studied companies was used to indicate correctness of the company's decision on incurring credit. The goal was to indicate that the company, which did not have the financial liquidity, or was operating on the border of its maintenance, could improve or regain the financial liquidity after incurring credit [5, 6, 7, 10]. However, the amount of properly incurred credit and the period of its duration were additionally taken into account because they had significant influence on the company's financial liquidity. Used models also enabled to indicate that the incurred credit influenced development of the subject's running a business positively, and even contributed to improve its financial condition. Nevertheless, it had to be incurred in a proper amount and for a proper period.

2. J. Gajdka's, D. Stos's and E.I. Altman's discriminant models

The J. Gajdka's and D. Stos's model reflects the best research results because it was developed in Poland, where Polish companies underwent discriminant analysis. The J. Gajdka's, D. Stos's and E.I. Altman's models are comparable, but were developed for different economic realities. When both models were compared, differences between them were indicated [8, 11].

The E.I. Altman's model has been used for dozens of years. It may distort a picture and a result of the research because it was used as early as in the 1970s. The credit risk related to issuing credit for investments is mostly the result of the credited company's wrong prediction of its realization [2, 4], and as it can also be noticed in the conducted research, the wrong credit amount, either too low, or too high, and the time period, for which it was incurred. The E.I. Altman's model enables to forecast the course of economic events happening in the company within subsequent two years of its operation. The "Z" value, calculated on the basis of 5 economic and financial ratios, is the basis of this model [3, 10]:

Table 1 E.I. Altman's guidelines for the company's classification (Source: E. I. Altman)

The "Z" ratio's value	*The chance of the company's bankruptcy*
Z <= 1.8	Very high
1.8 < Z < 3	Indefinite, but significant
Z => 3	Low

$Z = 1.2\ x_1 + 1.4\ x_2 + 3.3\ x_3 + 0.6\ x_4 + 0{,}999\ x_5$
where:
X1 - working capital / assets in total
X2 – net income / assets in total
X3 – EBIT / assets in total
X4 – net market value of the company/liabilities in total
X5 – trade (net sale) / assets in total

In Poland, D. Zarzecki undertook verification of discriminant analysis's models in 2003. The result of the analysis of these models conducted by D. Zarzecki shows

that the J. Gajdek's and D. Stos's model brings the best research results [8, 11]:

$Z= 0,7732059 – 0,0856425 \times X_1 + 0,0007747 \times X_2 + 0,9220985 \times X_3 +$
$+ 0,6535995 \times X_4 – 0,594687 \times X_5$
where:
X1 – revenues from the sale/assets in total,
X2 – (short-term liabilities/cost of production sold) x 360,
X3 – net profit/assets in total,
X4 – gross profit from the sale/net revenues,
X5 – liabilities in total/assets in total.

In this model, the cut-off point is 0.45, which means that a studied company is not endangered with bankruptcy, if the above value is reached. This cut-off point is different from the one given by E.I. Altman, but it is related to the used ratios, which are different in particular models.

Used models are very useful in assessment of the companies' crediting and are often used in practice [1, 3, 8]. Nonetheless, conducted analyses are not attempts to estimate specific worth of credit and the period for which the company should go in debt, but the credit's maximum worth and period. It may lead to issuing credit to a company, which may not be able to repay it in future.

3. The use of E.I. Altman's, J. Gajdka's and D. Stos's discriminant analysis models in order to indicate correctness of a decision on incurring credit on the example of 200 studied companies from Opole and Lubuskie provinces

In the Opole province, companies were studied with a comparison of the net profit in following years: a year prior to issuing credit, in the year of issuing credit and two years after issuing credit. The net income (division into following groups: from PLN 0 to PLN 100,000, from PLN 100,100 to PLN 200,000, from PLN 200,100 to PLN 500,000, and from PLN 501,000 to 1,000,000) and net loss were taken into account. The goal of such an analysis was to study range and opportunities of the obtained credit's amount in relation to the net profit and owned capital.

Table 2 Profit or loss of studied companies of the Opole province examined (100 examined companies, own development based on 100 studied companies of the Opole province.)

Year	*Profit 0-100,000*	*Profit 100,100 – 200,000*	*Profit 200,100 – 500,000*	*Profit 500,100 – 1,000,000*	*Net loss*
2010	28	33	15	4	20
2011	33	35	11	3	18
2012	35	37	10	3	15
2013	38	42	10	3	7
2014	37	41	12	5	5
2015	35	43	11	6	5
2016	36	41	12	6	5
2017	36	42	12	6	5

The net profit, or net loss, indicated whether credit contributed to maintenance and improvement of the companies' financial liquidity, or it led to their bankruptcy.

In 2010-2017, in the Opole province, companies of lower net profit (from PLN 0 to PLN 100,000 and from PLN 100,100 to PLN 200,000) were the most numerous there were 80 such companies. In the Lubuskie province, ranges between PLN 0 and PLN 100,000, and between PLN 100,100 and PLN 200,000 were dominant – there were 61 such companies. It should be noted that the studied companies tended to maintain net profit.

Table 3 Profit or loss of studied companies of the Lubuskie province examined (100 examined companies, Source: own development based on 100 studied companies of the Lubuskie province)

Year	*Profit 0-100,000*	*Profit 100,100 – 200,000*	*Profit 200,100 – 500,000*	*Profit 500,100 – 1,000,000*	*Loss*
2010	33	30	16	2	19
2011	30	31	17	2	20
2012	31	29	19	3	18
2013	29	28	22	3	18
2014	29	29	21	4	17
2015	27	32	22	4	15
2016	27	33	22	4	14
2017	28	33	20	4	15

Moreover, incurring credit even led to decrease of the number of companies, in which the loss occurred – from 20 to 5 in the Opole province, and from 18 to 14 in the Lubuskie province. It proves that the decision on incurring credit, which contributed to improvement of the financial liquidity, was correct. These data were summarized in tables 2 and 3.

In tables 4 and 5, the average net profit, average long-term and current assets, average worth of issued credit, and average loss of the companies that do not have the financial liquidity were presented.

In the table 4, it should be noted that the average value of issued credit amounts to PLN 251,425. It is the working capital facility, revolving in subsequent years, and issued in 2011. The value of credit constitutes c. 1/3 of average values of current assets that is c. 33%. It is the evidence that credit, which is c. 30% of current assets, causes maintenance of the financial liquidity, and does not cause financial destabilization.

While analysing the table 5, it should be noted that the average value of issued credit amounts to PLN 282,476. It is the working capital facility, revolving in subsequent years, and issued in 2011 as well. However, in case of companies of the Lubuskie province, its worth in relation to current assets is c. 5/10, so it is 52% of the credit's worth in relation to current assets. In this case, it can be seen clearly that companies maintain the financial liquidity harder with such debts. Moreover, the group of companies suffering loss reduced only from 18 to 15 in the year of

incurring credit. As late as in 2012-2017, the group decreased to 15 companies. But in the Opole province, the number of companies suffering loss decreased four times – from 20 to 5 with 30% relation of incurred credit to current assets, while in the Lubuskie province, the number of such companies decreased from 18 to 15 with c. 52% relation of incurred credit to current assets.

In conclusion, too heavy burden with debt and relying on foreign capital (over 52% of the current assets' value) leads to disturbance of the company's financial liquidity because the company is not able to pay such debt and use obtained funds properly and sensibly. Only these companies where foreign capital is 30% of current assets will use them sensibly and in accordance with their financial opportunities.

Table 4 Average net profit in relation to value of long-term and current assets of studied companies of the Opole province in PLN thousands(own development based on 100 studied companies of the Opole province)

Year	*Average Net profit*	*Average value of Long-term assets*	*Average value of Current assets*	*Average value of assets in total*	*Average value of the issued credit*	*Average Loss*
Before issuing credit						
2010	199,875 (80 companies)	450,456	658,475	1,108,931	X	225,154 (20 companies)
The year of issuing credit						
2011	205,895 (82 companies)	552,326	798,459	1,350,785	251,425	289,478 (18 companies)
After issuing credit						
2012	245,425 (85 companies)	582,954	821,258	1,404,212	X	198,487 (15 companies)
2013	263,125 (93 companies)	623,745	836,547	1,460,292	X	125,158 (7 companies)
2014	266,254 (95 companies)	639,532	840,128	1,479,660	X	134,578 (5 companies)
2015	295,365 (95 companies)	644,588	855,655	1,500,243	X	134,578 (5 companies)
2016	301,584 (95 companies)	630,548	845,581	1,476,129	X	141,587 (5 companies)
2017	305,596 (95 companies)	632,697	850,692	1,483,389	X	143,234 (5 companies)

Table 5 Average net profit in relation to value of long-term and current assets of studied companies of the Lubuskie province in PLN thousands(own development based on 100 studied companies of the Lubuskie province)

Year	*Average Net profit*	*Average value of Long-term assets*	*Average value of Current assets*	*Average value of assets in total*	*Average value of the issued credit*	*Average Loss*
Before issuing credit						
2010	199,875 (81 companies)	325,514	540,897	866,411	X	246,487 (19 companies)
The year of issuing credit						The year of issuing credit
2011	169,563 (80 companies)	330,458	551,312	881,770	282,476	229,634 (20 companies)
After issuing credit						After issuing credit
2012	182,634 (82 companies)	342,452	564,362	906,814	X	220,647 (18 companies)
2013	191,336 (82 companies)	378,654	571,235	949,889	X	205,418 (18 companies)
2014	195,479 (83 companies)	394,562	586,478	981,040	X	201,693 (17 companies)
2015	199,479 (85 companies)	402,264	599,647	1,001,911	X	200,004 (15 companies)
2016	201,587 (86 companies)	415,654	602,397	1,018,051	X	210,642 (14 companies)
2017	203,489 (85 companies)	422,963	623,547	1,046,510	X	220,284 (15 companies)

The credit risk taken by a bank due to granting funds was minimal in case of companies with less credit. It is demonstrated by another calculations and use of E.I. Altman's,J. Gajdka's and D. Stos's methods. Nevertheless, granting funds constituting c. 52% of the company's current assets was too dangerous both for the bank and the company.

Analysing course of economical events since the moment preceding issuing credit [9] and subsequent years of the activity's duration, five selected ratios corresponding to particular models were used. The cut-off points for two chosen discriminant analysis models were obtained.

On the example of the studied companies of the Opole province, the Altaman's model shows significant improvement of the ratio in 2011 (3.45), when companies incurred credit, in relation to 2010 (3.12). Improvement of the selected companies' financial condition proves the above. In subsequent years, this value is the same, and in 2017, increases to 4.19.

The J. Gajdka's and D. Stos's model also indicates values above the cut-off point from 0.79 to 1.08 in 2010-2017. Only in companies suffering from loss the cut-off's ratio tends to deteriorate with the use of both methods, which proves that even properly selected credit does not improve the companies' financial liquidity. The values described above present research included in the table 6.

Table 6 The use of E.I. Altman's, J. Gajdka's and D. Stos's discriminant analysis models on the example of 100 studied companies from the Opole province (own development on the basis of data of 100 selected from the Opole province)

E.I. Altman's model	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
The number of companies showing profit	80	82	85	93	95	95	95	95
The average "Z" ratio for companies	3.12	3.45	3.32	4.11	4.15	4.17	4.18	4.19
Absence of risk, values close to and above 3.0	low	absence	absence	absence	absence	absence	absence	absence
The number of companies showing loss	20	18	15	7	5	5	5	5
The average "Z" ratio for companies	1.98	2.36	1.95	1.72	1.80	1.83	1.85	1.85
Absence of risk, values close to and above 3.0	high	medium	high	high	high	high	high	High
The J. Gajdka and D. Stos's model	2010	2011	2012	2013	2014	2015	2016	2017
The number of companies showing profit	80	82	85	93	95	95	95	95
The average "Z" ratio for companies	0.79	0.93	0.88	1.02	1.05	1.06	1.08	1.08
Absence of risk, values close to and above 0.45	absence	absence	absence	absence	absence	absence	absence	absence
The number of companies showing loss	20	18	15	7	5	5	5	5
The average "Z" ratio for companies	0.31	0.39	0.37	0.34	0.33	0.35	0.36	0.37
Absence of risk, values close to and above 0.45	high	medium	high	high	high	high	medium	medium

Table 7 The use of E.I. Altman's, J. Gajdka's and D. Stos's discriminant analysis models on the example of 100 studied companies from the Lubuskie province (own development on the basis of data of 100 selected from the Lubuskie province)

E.I. Altman's model	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
The number of companies showing profit	81	80	82	82	83	85	86	85
The average "Z" ratio for companies	2.78	2.79	2.88	2.97	3.02	3.05	3.15	3.16
Absence of risk, values close to and above 3.0	absence	absence	absence	absence	absence	absence	absence	absence
The number of companies showing loss	19	20	18	18	17	15	14	15
The average "Z" ratio for companies	1.02	1.05	1.09	1.25	1.30	1.31	1.38	1.39
Absence of risk, values close to and above 3.0	high	high	high	high	high	high	high	High
The J. Gajdka and D. Stos's model	2010	2011	2012	2013	2014	2015	2016	2017
The number of companies showing profit	81	80	82	82	83	85	86	85
The average "Z" ratio for companies	0.60	0.68	0.78	0.69	0.68	0.69	0.72	0.75
Absence of risk, values close to and above 0.45	absence	absence	absence	absence	absence	absence	absence	absence
The number of companies showing loss	19	20	18	18	17	15	16	15
The average "Z" ratio for companies	0.27	0.28	0.28	0.35	0.36	0.35	0.37	0.38
Absence of risk, values close to and above 0.45	high	medium	high	high	high	medium	medium	medium

In turn, in the table 7, E.I. Altman's, J. Gajdka's and D. Stos's models were also used during research of companies of the Lubuskie province. The above research shows that companies, which maintained the financial liquidity with incurring credit, improved their financial condition, but their cut-off point's ratio are different from ones noted in the Opole province.

In the E.I. Altman's model, improvement can be seen in 2010-2017 – ratio's value increased from 2.78 to 3.16. Whereas in the J. Gajdka's and D. Stos's model, the ratio's values increased from 0.60 to 0.75. It means that credit's worth constituting 52% of the current assests' worth is too heavy burden, and prevents from significant improvement of the financial liquidity. Moreover, it does not show the ratio similar to the one obtained in research in the Opole province.

Furthermore, the cut-off points' values of the companies showing net loss in the Lubuskie province do not show significant improvement of the financial liquidity, but they slightly vary in 2010-2017. In the E.I. Altman's method, they vary from 1.02 to 1.39, and in the J. Gajdka;s and D. Stos's method – from 0.27 to 0.38.

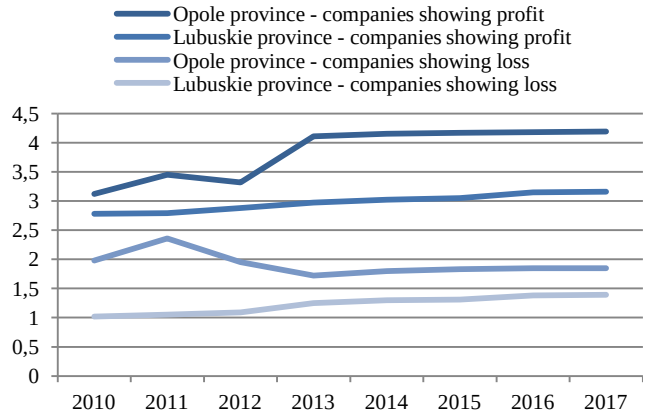

Figure 1: The use of E.I. Altman's model in the analysis of 200 companies of Opole and Lubuskie provinces showing profit and loss in 2010-2015 (own development on the basis of data of selected companies from Opole and Lubuskie provinces).

It evidences that greater worth of credit could not ensure companies satisfactory improvement of the financial liquidity, but worsened their situation. Analysing net profit of the companies, it can be noted that issued credit influenced their development positively.

There, its huge influence on the companies' net income can be seen. Thanks to opportunity to incur credit, companies could develop dynamically and as they planned in their assumptions with credit constituting 30% of the current assets' worth. Only credit constituting 52% of the current assets' worth did not cause major changes in many companies and did not lead to improvement of the financial liquidity of the greater number of companies showing net loss.

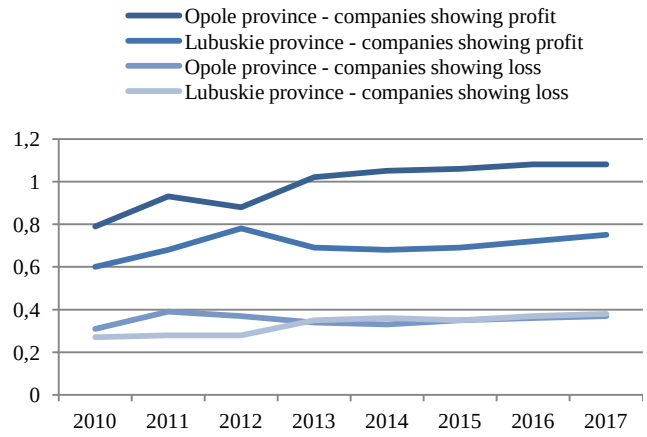

Figure 2: The use of the J. Gajdka's and D. Stos's model in the analysis of 200 companies of Opole and Lubuskie provinces showing profit and loss in 2010-2015 (own development on the basis of data of selected companies from Opole and Lubuskie provinces)

The sensibly selected credit resulted in the greater increase of net profit and contributed to the increase of net income and profit, without which the company could not develop and reach significant results.

4. Conclusion

It should be emphasised that contracted credit in studied companies contributed to improvement of the financial liquidity. However, it was mostly in case of companies, whose credits were c. 30% of the current assets' worth. Furthermore, in case of companies of the Lubuskie province, whose credits were 52% of the current assets' worth, the financial liquidity was not improved as much as in case of lower credits incurred by the studied companies of the Opole province. Nevertheless, credits enabled companies to settle current liabilities, which is proven by lessened number of companies suffering from net loss because such a phenomenon occurred in the group of 100 studied companies in 2010-2017. Therefore, companies maintained good financial condition after issuing credit. It should be stated clearly that the decision on incurring credit was, indeed, correct. But it should be borne in mind that the amount of incurred credit must not exceed specific worth preventing from repaying incurred credit and settling liabilities, which could lead to the company's inability to debt service. That is why c. 30% of the company's current assets' value, resulting from research of the companies, is the optimal amount.

The period, for which credit was incurred, is highly significant, but the studied companies contracted the working capital facility for one year with the possibility to renew it in subsequent years, which did not affect research and cause its distortion.

The companies that had unevenly balanced liquidity or needed additional financial resources for the functioning on the market, and that took up a credit above the value exceeding 52% of the external funds in relation to their current assets, did not maintain the liquidity, and only 4 companies improved it in relation to 15 companies that were at risk of bankruptcy, which was reported in the Lubuskie Voivodeship. While the number of companies in Opole Voivodeship, which improved their liquidity, is 15, that is several times more than in Lubuskie Voivodeship, but the improvement occurred thanks to a taken credit, however the debt amounted only to 30% of the external funds in relation to their current assets. Therefore, there must be a firm answer that the credits that are incurred in the form of cash and account for more than 52% of the external funds in respect of current assets will not have a good impact on the financial condition of the studied companies, since such a capital obligation and interest liability constitutes a major burden for the company, which must within next months, after a credit was incurred, pay it back to the bank.

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REVENUE MANAGEMENT BASES TO CREATE TICKET PRICES

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Abstract: *Revenue management is the application of disciplined analytics that predict consumer behavior at the micro-market level and optimize product availability and price to maximize revenue growth. This article discusses the basic aspects that an airline company should know before starting to use revenue management for pricing. We briefly describe the customer segmentation principle, try to outline the ticket pricing principle and generally describe the factors influencing air transport demand. These theoretical bases form the starting point for understanding the revenue management and its use in air transport.*

Keywords: *revenue management, air tickets, airline company, segmentation, pricing*

1. Introduction

History says that after airline deregulation, the changes in airline ticket pricing gradually led to a new way of selling. The revenue management has changed since then - it has undergone several innovations and many air ticket sales managers are currently dealing with this issue.

The aim is not only to understand the behavior of customers, but to predict their purchasing behavior so that it is possible to work best with the ticket prices. As always when dealing with management, demand also plays a key role in applying revenue management. There are several principles in pricing and selling. We are going to focus on three main areas – a customer segmentation, demand and pricing.

Revenue management is a practice that has been adopted by service organizations across all spheres. It originally started as an airline industry concept, but soon emerged in other industries as well. The practice of revenue management has been discussed and digressed over the past few decades to determine its exact impacts on the industry and its main benefits. However, there still exists limited research on the exact effects of revenue management on business-to-business relationships. The knowledge about how feelings of price fairness affect loyalty is quite limited as well. The main goal of revenue management is to maximize the revenue with the help of effective management of three essential domains – pricing strategy, control of availability and inventory control. The inventory controls usually depend on the availability of resources such as aircraft, gasoline, and employees. The control of availability simply refers to the total number of empathy seats on board the aircraft.

2. The principles of revenue management

In addition to validating corporate strategy, revenue management is a tool for the implementation of strategy. The function must ensure successful coherence with airline-wide business priorities, and this alignment comes in many forms:

Revenue management is designed to prioritize passengers based on fares and to give seats to the highest fare. Even if the statistically optimum solution is only a $1 better than the next alternative, and those $1s can add up to tremendous value over all the price points on all flights. However, as a strategic tool, revenue management needs to recognize the value of a more robust solution that biases availability to its target market segments, rather than always seeking the additional $1 from non-targeted (presumably more transitory) market segments. Greater availability for frequent flyers or for corporate customers are examples of strategic initiatives. One airline I worked with specifically rejected the "optimum" revenue management solution in favor of a more explicit focus on local passengers whom it felt were more consistent with their long term corporate plan.

The last seat on a flight could sell for $1000 for a desperate passenger. On the other hand, to fill an empty plane, an airline could charge $19 for incremental passengers. A pure revenue maximization strategy can lead to even more market mayhem than the confusing airline pricing structure does already. Instead, a "full service" airline is reluctant to confuse the market with $19 fares and the "low fare" carrier is reluctant to try to extract the last dollar out of its customers. Revenue management must operate within the constraints of the brand and serve to support the airline's brand image in the marketplace.

When threatened by a new competitor, or when trying to gain a foothold in a new market, gaining market share may be more important than revenue maximization per the revenue management model. Also, many airlines serve "strategic" routes to maintain presence in key points of sale so tactics should conform to strategic objectives.

Pricing and revenue management departments must adopt a "total revenue" perspective as Spirit Airline and Allegiant Air had. Although all airlines need to be pursuing "total revenue management", these two airlines have even greater reliance on ancillary fees. Maximizing

revenue from the base fare - as done in most airline revenue management systems - would potentially conflict with the overall strategy of the airline.

Although cash flow is less a strategy than a tactical necessity for some airlines, revenue management must be in sync with the corporate direction on cash. Restricting sales in anticipation of future bookings may not meet the short-term cash needs of the airline. Also, an airline may prefer to prudently position itself for a future economic weakening as opposed to assume the "status quo" in the face of extraordinarily strong market demand.

Airline revenue management has become a strategic tool, not an effective strategy on its own. It has key and integrative roles in both validating and implementing corporate strategy with the respective functional departments, both which are critical for effective strategy execution.

3. Pricing of airline tickets

The calculation of the final air ticket price is a demanding process for each airline company as several factors have to be taken into account. In an effort to maximize profits at the lowest cost, we need to monitor not only the past passengers demand, but also to estimate the future demand and movement of fuel prices and other possible cost growth, to keep an eye on the competitive prices of competitor airlines and the overall anticipated air transport market.

In principle, the more the input data the airline monitors, the more accurate the guess of market development and therefore the pricing, including the actual sale, can be. An airline company using the revenue management must understand the costs, the cost and pricing principles so that the set profit margins can be reached.

In addition to the inputs mentioned above, the actual value of the flight, it means the benefit for a passenger, is to be assessed. If the passenger feels that the air ticket is overpriced with regard to the services provided, it is assumed that he can search for the prices of competitor airlines' air tickets, thereby increasing the customer's loss. However, for the airline, the most important part of pricing is the calculation of own costs due to the cost-effectiveness of the flight route.

It happens that if an airline company is able to cover its costs very well and is profitable, it can afford to open a less profitable route - opening a new destination gets into awareness of passengers. Of course, such a flight route may not be open for a long time, usually just a few months, and only if the expected interest of the passengers increases and the route becomes profitable, can be offered for a long time. However, it is usually a good thing to gain passengers´ favor in order to overtake the competitor and bring something else.

4. Segmentation of Customers

Segmentation of customers, in addition to clarity, should in particular provide information on the diversity of customers of the airline, as well as help adjust the price of tickets. The more the airline company knows about its customers, the better it can work with the prices because it knows the so-called tolerance limit. For example, holiday and leisure travelers pay a different price for an air ticket comparing to passengers traveling for work.

The segmentation of leisure travelers may continue to continue, for example, for leisure and family travelers, while family travelers sometimes pay a little more for a ticket just to attend family celebrations or other important events. Such demand control also affects the introduction of new destinations, fees, and other changes.

5. Passengers´ demand for air tickets

The demand analysis helps ensure better revenue management decisions. The demand for tickets is more varied than laymen could think. Passengers choose their destinations based according to attractiveness, family ties, work, friends, and many other factors, which causes fluctuations in the demand curve. Even though several airlines currently have a redesigned revenue management system and are looking for variables from the demand sphere, it is still extremely challenging to predict the further development of demands because sometimes the situation is developed completely differently from the predicted state.

Air passengers' demand is also related to the season, days of the week and individual parts of each day. Increased or decreased demands also depend on holidays in the countries, economic conditions and the school year. At least the time for such changes is important to observe for each airline in order to apply pricing successfully with the use of revenue management.

In practice, seasonality is one of the strongest impacts because it affects every service provider. For example, school calendar and holidays make a major contribution to seasonality. They not only affect demand for air travel but also hotels, car rental and many other travel-related products and services.

The demand for air transport can generally be divided into controllable and uncontrollable. Controllable, as already outlined by the title itself, we can predict on the basis of historical statistics, which is essentially tracked by each airline. It usually comes from a periodically repeating pattern that is linked to events and activities that are repeated every year.

Uncontrollable demand is somewhat more complicated because the airline must track new events, such as sports as Olympic games that are held each year in another country, or other social activities such as openings. Sometimes airlines are responding to the prestigious vernissages by temporarily compressing flights to a given

destination, or by opening an airline for a certain time to the city where a major event takes place. The most important events are sports like football and tennis, concerts of world-famous artists and relevant musical performances. Whether it's a football championship, a Grand slam tennis tournament or a big concert, these events can attract tens of thousands of people who are also potential customers of airlines. These people would not take advantage of the air service if they did not force their interest in the event.

Winter and summer holidays, holidays and great holidays in the year, Christmas or Easter, according to some analysts, are subject to controllable demand because we can predict the arrival of such a peak and an increase in demand. Summer holidays are more complicated time for airlines because passengers are scattered to dozens of destinations and it is not always possible to estimate more accurate changes in demand as the popularity of the destination is unstable.

The proper use of revenue management tools, such as restrictions, overbooking, and others, leads to stabilization of demand and the airline is experiencing moderate demand fluctuations. The peak period occurs when demand is very high. Most often it is connected with the summer season, when the school holidays. This convention has been subject to changes in recent years as the average traveler's age is increasing and is not so affected by the school calendar. The peak period usually starts in May and ends at the end of September and October. In these months, demand often exceeds capacity.
The off-peak period occurs when the demand is very low. At that time, capacity usually exceeds demand. In response to this phenomenon, airlines provide discounts on aircraft seats, which we can call the stimulation of demand. They can also cancel some flights where the occupancy is very low.

The period of the regular season is specific because the demand for seats in the aircraft is normal. Its privilege is the fact that the demand for business classes is the greatest typically, the usual season is spring and autumn. Although seasonal demand is not controllable, it is at least generally predictable.

6. Conclusions

The revenue management is a collection of tools that can influence the pricing of air tickets and the profitability of airlines. For the best results, we need to know not only the revenue management tools but also the basics of using this kind of management.

Revenue management is the practice of maximizing a company's revenues while selling the same number of products or services. Also called yield management, some consider it both an art and a science. It employs a mix of pricing strategies and systems to maximize yield. Industries that have products or services that expire -- such as hotel rooms, banquet halls and meeting rooms in the hotel industry and airplane seats in the airline industry.

The concepts of REVENUE management in the airline industry are known to have an impact on customer feelings of price fairness and it also affects customer loyalty. As expected, customers consider the price to be unfair when they realize that the airline is using price strategies to generate profit. Another issue is that revenue management also ends up having a negative effect on leisure travelers because the business travelers are less price sensitive. Finally, price fairness is not a proper predictor of loyalty. Customers base their loyalty on different factors.

In order to reap the full benefits of revenue management, a company must measure a number of variables. These metrics depend on the industry, but in any case, should indicate how well a company uses revenue management to impact the bottom line. A culture of measuring, comparing and making adjustments spills over to other aspects of the business, which makes the overall company more efficient, driving down costs and increasing profitability.

Selling tickets is not just good marketing, but also constant monitoring the market, economic conditions, the business environment, customer confidence and competition. Detailed processing of the monitored variables leads to the adaptation of the ticket prices so as to reach the widest possible public and to get as many passengers as possible.
If we want to implement revenue management in our airline, we have to think about the volatility of demand, to see how it changes not only during the year, but over the individual hours in the last few days. By just looking at demand, customer segmentation and refined pricing, we make the most of our revenue management for our airline company.

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SIMULATION MODELING AND ITS USE IN CONSTRUCTION-TECHNOLOGICAL PREPARATION FOR AERIAL WORKS

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Abstract: *In general, construction processes are characterized by diverse technological composition and wide range of usage of construction machinery and mechanization and thereby concurrent operations by working teams of varying manpower and professions. Their numbers grow with increasing complexity of construction, placing increasing demands on coordination and construction management. Systems defined in such way include numerous factors that are mutually affected and whose exact behavior is difficult to predict. Therefore, construction–technological preparation is of extraordinary importance within the construction processes. When modeling construction processes, the critical task is choosing the model that would lead to the desired objectives in the most efficient way. The model assembled should facilitate investigation into construction process in real–world conditions and evaluation of proposed structure of the process based on requested criteria. Preparation of construction processes carried out by helicopters (aerial works) must recognize the effects of unpredictable changes in construction conditions as well as specific conditions of the helicopter works. Complexity of such system can be modeled using simulation models. This paper analyses the present state in the field of simulation of construction preparations and conceptual design of construction process simulation model implemented with use of helicopter, including outputs of the solution to date. Partial results of the research indicate its interdisciplinary nature, so in future, the acquired results could also be applied outside the construction field, mainly in general logistics.*

Keywords: *simulation model, helicopter, construction process, building industry, logistics*

1. Introduction

Construction-technological preparations mostly use deterministic models, which approach real world through appropriate coefficients. Models created in this way are relatively simple but, under certain conditions, are sufficient for planning technological procedures. However, for constructions performed in more complex conditions, the deterministic approach can be biased due to effects invoked by random changes [1].

This is predominantly caused by insufficient range of options of traditional „ground“ building methods when realizing demanding constructions located in complex terrains or in densely built-up urban areas. In such cases, construction may be performed with use of unconventional technologies, such as helicopter. Constructions works using helicopters are also called aerial works.

Helicopter, owing to its qualities, represents a practical and irreplaceable means of transport in many fields. Possible vertical takeoff or landing with no dependence on long takeoff and landing runways provides helicopters with exceptionally wide operational space as they do not require any large or special landing and takeoff grounds. Unusual maneuvering abilities allow helicopters be flown even in immediate proximity to terrain. Lower airspeed of helicopter, compared to other means of aerial transport, is an advantage in transportation of loads [2].

Helicopter is able to steer in all directions and, unlike conventional airplanes, is capable of stopping in mid-air – hovering. Such combination of characteristics is the very reason for use of helicopters in the building industry [3].

2. Simulation Modeling and Its Current Use in Construction Preparations

The ideal model of construction process should predominantly reflect the accidental nature of building production. Random factors, which could affect the course of construction processes, include geological, hydrogeological and morphological conditions, location of infrastructure, climate conditions, traffic conditions, supply chain fluency, material quality, machinery and equipment downtime, project adjustments, flow of finance, changes in deadlines, etc. [1]

Figure 1: Simulation model of concrete process with depicted duration of simulation run [1]

The actual course of aerial works is rather difficult to predict using deterministic models, mostly due to

specificity of the works caused by the aforementioned random factors affecting helicopter operations [4]. Inaccuracies in time- and cost-planning then negatively impact the overall construction process, which, in turn, impacts both technological process as well as planning of construction process and subcontractor coordination [5].

If we admit that random factors impact the process, the required outputs can only be achieved with certain probability. The most accurate representation of reality can be achieved by emulation of the actual object using a simulation model. In contrast with the deterministic approach, this is based on creation of mathematical-logical models [1].

The essence of simulation modeling is creation of computer model of construction process and simulation of its progress in real world and subsequent experimentation with the assembled model [6]. An example of simple simulation model of a concrete process is shown in the Figure 1.

Simulation is not a tool that would directly yield the optimum solution. Simulation modeling is rather a support tool, especially needed by the constructor in situations when multiple solutions are available to carry out the construction process. It aids in choosing the optimum construction technology based on output values for the respective variants [1].

In foreign countries, use of simulation modeling in construction preparations was researched by several authors, such as Mahmoodzadeh and Zare [7], who studied probabilistic prediction of effects of expected geological conditions, construction duration and overall costs on road tunnel construction. Same approach was employed by Alsudairi [8], who analyzed potential of simulation approach in cost reduction of construction works, shortening the time of construction and building maintenance.

Many authors dedicated their work to analysis of simulated climatic conditions in future and evaluation of their impact on construction processes. To evaluate the magnitude of such impact, many authors have successfully implemented the simulation approach (e.g. Lee et al. [9], Jung et al. [10]). However, only the "conventional" construction processes were simulated, including common cranes and other usual construction machinery.

Despite this, research in the field of simulation modeling in construction preparation has just begun and many authors have emphasized the necessity of publishing further studies utilizing the simulation approach.

2.1 Choice of Appropriate Simulation Program

Simulation model can be assembled using a variety of software available on the market. In 2017, Slovak University of Technology bought full license of the renowned MATLAB programming environment, which includes the Simulink simulation extension. For this reason, we deem use of this tool appropriate. Alternatively, the ExtendSim simulation software (formerly Extend) can be used, for instance.

2.2 Partial Conclusion

The considered model of aerial works may allow for practical verification of the simulation approach potential in this under-investigated area of building production. Thereby, it would contribute to large-scale application of progressive simulation modeling tools in building practice as well as create the framework for development of institutionalized education in the field of simulations. Many current authors have considered these tasks as the most relevant.

3. Simulation Model of Aerial Works

3.1 Proposed Concept of Simulation Model

The proposed simulation model of aerial works will include effects of random factors, including the aforementioned weather conditions, which have the highest impact on helicopter operation in this construction technology, thereby affecting its most relevant property – maximum payload capacity that can be attained.

This part of algorithm can be created in different ways, each of them providing predictive data for different period of time. On Slovak market, Slovak Hydrometeorological Institute (SHMÚ) is engaged in this field, providing numeric predictive model European Centre for Medium-Range Weather Forecasts (ECMWF) as well as numeric model ALADIN developed directly at SHMÚ [11].

The ECMWF numeric model provides medium-term probabilistic predictions, calculated for 10 days ahead. Output of the model is anticipated time course of the respective meteorological elements. These are presented in graphical form, so-called meteogram, which summarizes respective outputs of the predictive model pertaining to specific geographical point – location of choice [11].

Algorithm of the simulation model will also consider technological-economical parameters of helicopters, e.g. cost per flight hour. At the same time, it respects technological, organizational and legislative regulations and principles used in the field of aerial works. When assembling a simulation model, knowledge of relevant legislation is of exceptional importance as it implies numerous requirements or limitations. By their nature, aerial works belong to a more general commercial air transport (CAT) category.

The major legal regulation in the field is the Act No. 143/1998 Coll. on Civil Aviation (Civil Aviation Act) and on Amendments of Some Acts as amended by later regulations. Another important aviation regulation is the document named "JAR-OPS 3 Commercial Air Transportation (Helicopters)" issued by the former international organization Joint Aviation Authorities

(JAA). Currently, the field has been governed by the European Aviation Safety Agency (EASA).

Outputs of the simulation are to be implemented into the processes of construction-technological preparation. This means the basic technological documents (construction schedule, financial plan, etc.) will more accurately match the actual construction due to their optimization based on the simulation model outputs.

Creation of simulation model incorporates the following sequence of steps:

1. imaging construction processes (mostly concrete and assembly works) using helicopters in order to acquire perfect knowledge of succession and duration of respective processes carried out at the construction site, including the way they are interconnected and dependencies between the processes;
2. assembly of simulation scheme of observed construction processes using knowledge acquired by the imaging;
3. creation of simulation model of the construction process based on the proposed simulation scheme and calculation of the model;
4. verification of the created simulation model through comparing its outputs with real-world processes that have already been carried out;
5. comparing outputs of simulation modeling with outputs obtained by deterministic approach in order to evaluate the relevance and effectiveness of simulation methods in construction preparation.

The following subchapter of this paper describes practical implementation of the first point, i.e. imaging of construction process in real-world conditions.

3.2 Input Data for Creation of Simulation Model

One of the sources of input data for creation of simulation model was a construction project of three ropeways in the mountain town of Szczyrk, Poland, realized in 2017. Laying of concrete footings and mounting of track towers for all three ropeways was carried out using a helicopter. The helicopter used in the operation was of the Mi-8 type with maximum hanging payload capacity of 3,000 kg.

During our observation, one of the ropeways had a tower being mounted. Altogether, the operation required mounting of 10 towers with pipe-like cross-sections. The towers were 10.17 – 26.41 m high, weighing 11,541 – 23,391 kg. Mounting of towers upon pre-installed iron-reinforced concrete footings with embedded anchoring screws was carried out in sequence from the upper station towards the lower station.

N.	Level above Sea	Total schaft lenght [m]	Towers with ladder									
			Shaft 1		Shaft 2		Shaft 3		Shaft 4		Shaft 5	
			Length m	Weight kg	Length m	Weight kg	Length m	Weight kg	Length m	Weight kg	Length m	Weight kg
1		6,05	6,05	2.052								
2		7,15	7,15	2.374								
3		10,17	10,17	3.213								
4		21,86	6,98	3.657	5,88	2.726	9,00	2.735				
5		23,77	3,57	3.964	5,60	3.856	5,32	276	9,28	3.099		
6		26,41	3,13	3.638	4,48	3.767	5,60	3.856	7,56	3.444	5,64	1.628
7		19,42	6,50	3.440	4,20	2.072	8,72	2.667				
8		21,95	3,15	3.656	5,60	3.856	7,28	3.212	5,92	1.704		
9		20,19	6,99	3.661	7,00	3.144	6,20	1.747				
10		14,11	7,91	2.933	6,20	1.747						
Total weight			78.124 kg									

NOTE: The indicated valued are calculated theoretically. Based on experience, please add 5 - 10% !!!

Figure 2: A fragment of weight tables provided by producer to supplier of aerial works (authors)

The use of helicopter in mounting towers had been considered since the project design stage, so the towers were designed and structurally adjusted to the exact mounting procedure. Considering their weight, which exceeds the helicopter capacity, the towers are divided into a predetermined number of segments during their production. At the construction site, the segments are connected by collars with screw connections while exact fitting of components is achieved using a special structural preparation.

Hence, several flights are needed to complete assembly of a single tower. For this purpose, producer of the steel structure provides the supplier of aerial works with tables detailing the number of components, their dimensions (lengths) and weights, which the constructor uses to elaborate technological plan of assembly, mainly allocation of segments to individual flights.

A section of the tables directly used during construction is shown in the Figure 2. The pipe-like shaft of each tower (rows 1 – 10) is divided into respective segments (columns Shaft 1 – 5) separately listing specific length and weight of each segment. For simplicity, tower components with exclusive machinery-related functions are not listed, such as tower head, work platforms and roller batteries. From the point of construction technology, these represent significantly heavier loads, which require further, separate helicopter flights.

Shaft assembly procedure of one of the towers directly in terrain is shown in the photograph in the Figure 3.

Figure 3: Stepwise assembly of the pipe-like shaft components of a tower (authors)

3.3 Assembly of Simulation Scheme and Creation of Simulation Model

The following procedural step is assembly of the simulation scheme, which is used as the basis for actual simulation model of aerial works. Besides the input data, which are acquired as described in the previous subchapter, this stage requires elaboration of exact sequence of tasks during the works and answering numerous questions pertaining to technological and organizational aspects:

- what method is used in what intervals to refuel the helicopter during aerial works;
- which tasks carried out during the works can and cannot be disregarded in developing the model;
- what is the basis for pilot's decisions in relation to overall logistics of the aerial works;
- what are the critical aspects that decide deployment of specific helicopter type at a specific construction.

After answering the questions above, it was possible to compile a preliminary technological method of implementation of construction works using helicopters, which is listed here in an abbreviated form, due to limited extent of this paper:

1. accurate survey of terrain;
2. choice of appropriate landing site for the helicopter, mainly used for refueling during the works;
3. choice of deposition site for assembled structures; this place is not intended for helicopter landing, the load is lifted with the helicopter hovering;
4. choice of means of attachment – hooks, chains, etc., depending on the nature of transported loads and terrain configuration;
5. inspection of trajectory before the flight due to possible occurrence of obstacles;
6. actual assembly or laying of concrete by helicopter according to a previously elaborated flight plan (see chapter 3.2), which must also be available at the deposition site.

3.4 Partial Conclusion

Imaging of aerial works in the town of Szczyrk, Poland should only be considered as the pilot stage of input data acquisition. During the imaging, it was not possible to record all the relevant data, such as time allocated to the respective operations. Therefore, further research will focus on acquiring the missing data. Subsequently, the very simulation model will be processed based on the knowledge described in chapters 3.2 to 3.3.

4. Conclusions

Presently, simulation modeling is commonly applied in several industrial sectors, e.g. in mechanical engineering industry. Construction production has several specific characteristics appropriate for use of simulation methods but the approach has not been used to date with only few exceptions.

Therefore, primary objective of our research is to verify the appropriate use of simulation modeling in construction preparation, thereby providing conditions for possible implementation of the model in construction practice.

Approach to the topic represents interdisciplinary research, therefore in future, the results could possibly be used outside the building industry.

Acknowledgements

Authors of the paper express their gratitude for collaboration to Leitech, s.r.o., Bratislava and UTair Europe, s.r.o., Bratislava.

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MATHEMATICAL MODEL OF A VISCOELASTIC RUBBER MATERIAL FOR VIBRO-ISOLATION APPLICATIONS

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Abstract: *For the description of material properties there is used the Mooney-Rivlin visco-elastic model. The time-dependent behavior of rubber for the production of vibro-isolating components is investigated using a compression test. The article presents the results of experiments in various relaxation modes. A viscoelastic mathematical model of filled rubber is designed. The experiment is designed to determine model parameters for equilibrium and instant behavior of material from measured data. The obtained results are verified by numerical simulation of relaxation tests using the finite element method.*

Keywords: *filled rubber, visco-elasticity, stress relaxation, constitutive relations, parameters fitting*

1. Introduction

This paper aims to the experimental investigation of mechanical properties of filled rubber, from which are produced vibro-isolation segments (silent blocks) (figure 1), designed for cushioning of trams. These segments are mounted between the tire and the wheel body. During operation, they are stressed by compression (radial wheel load) and shear (torque transfer).

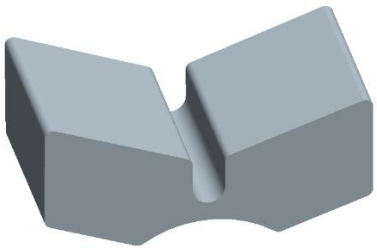

Figure 1: The vibro-isolation segment

2 Experiment

In order to describe visco-elastic properties of the filled rubber for silentblocks production, a number of laboratory experiments were carried out. Types of measurements can be sorted into four groups:

- *Preloading* for elimination of the Mullins effect [10], [11], which would cause inaccuracies in other measurements.
- *Gradual relaxation measurements* were performed to determine equilibrium stress values as a function of deformation.
- *Relaxation tests* were performed to determine the viscoelastic properties of the material.
- *Periodic tests* at different loading rates show the dependence of mechanical properties of rubber on deformation rates.

The measurements were performed on eight block-shaped test specimens that were milled from the vibro-isolation segments described in the introduction. Segments are produced in two sizes, so the sample sizes vary. They are listed in the following table 1.

Specimen dimensions x × y × z [mm]			
specimen number	*dimensions*	*specimen number*	*dimensions*
1	44.2 × 27.0 × 22.1	5	44.3 × 26.9 × 22.0
2	43.0 × 30.0 × 26.6	6	42.9 × 29.9 × 26.5
3	44.3 × 26.4 × 22.2	7	42.9 × 30.0 × 26.5
4	44.2 × 26.4 × 22.0	8	42.9 × 30.0 × 26.6

Table 1: Specimen dimensions

Further described measurement was performed on the equipment, shown on a schematic figure 2, and on a standard testing equipment TIRATEST.

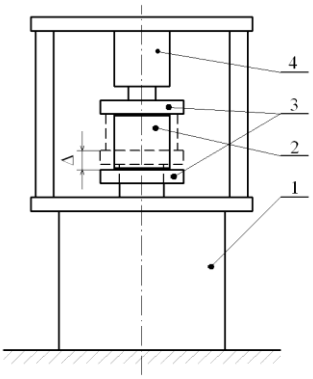

Figure 2: Scheme of the measuring equipment

Legend of the figure 2:

1. hydraulic cylinder (motor) with a position sensor and a position controller
2. specimen of the rubber material
3. plates that the specimen is compressed between
4. loading force sensor

The specimens were tested by a compression test with controlled deformation. Values of displacement, loading force and time were recorded into text files at a sampling rate of 50 Hz. In the experiments, it was necessary to

minimize the coefficient of shear friction between the specimen and the front faces of the plates in order to prevent undesirable deformations of the specimens. For this purpose, the faces (made of ground steel) were lubricated with silicone oil.

3. Measured values

The values measured up during the tests shows figures 3 to 8. There are labels of measured quantities and its units in each graph.

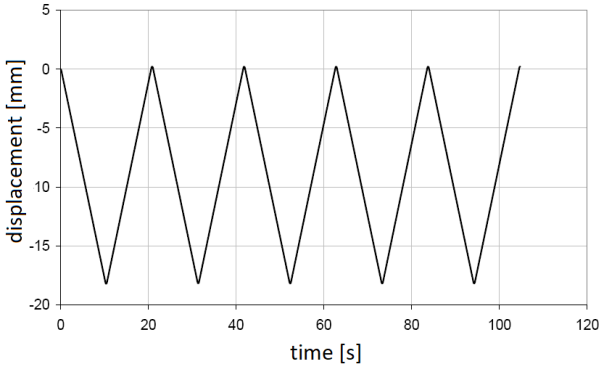

Figure 3: Dependence of displacement-time for specimen preload

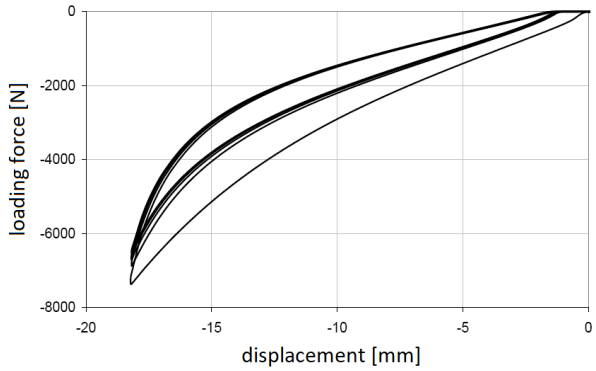

Figure 4: Dependence of loading force-displacement, specimen 1

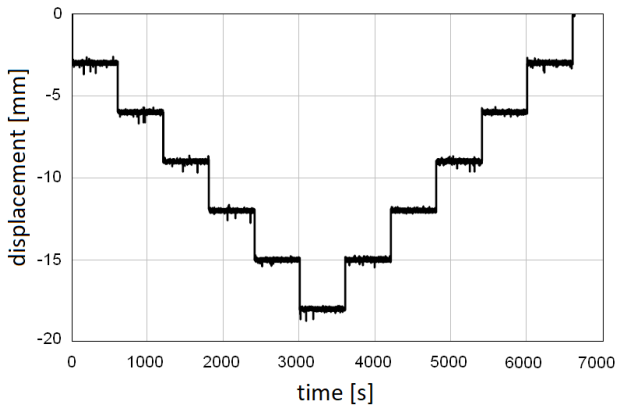

Figure 5: Dependence of displacement-time, specimen 2, displacement rate 900 mm/min, measuring of gradual relaxation

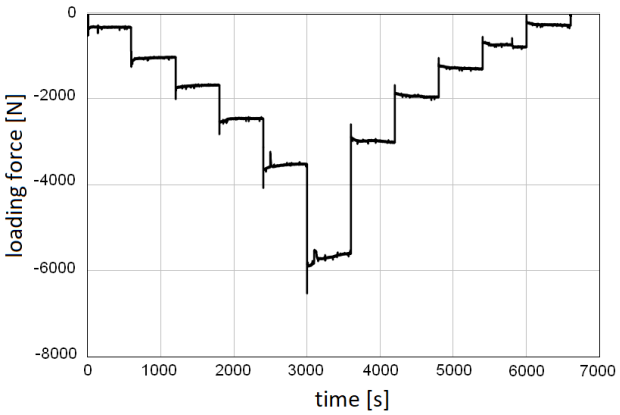

Figure 6: Dependence of loading force-time, specimen 2, measuring of gradual relaxation

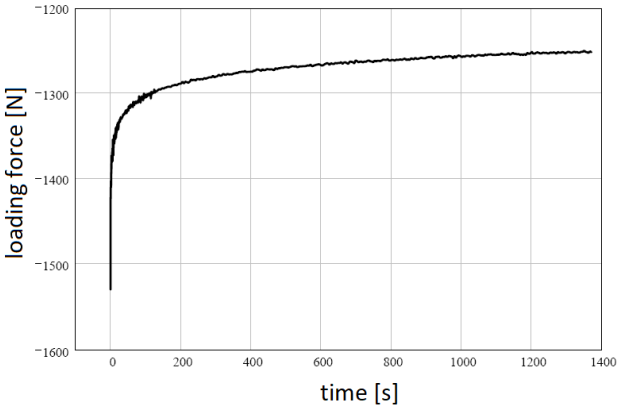

Figure 7: Dependence of loading force-time, relaxation test, specimen 1

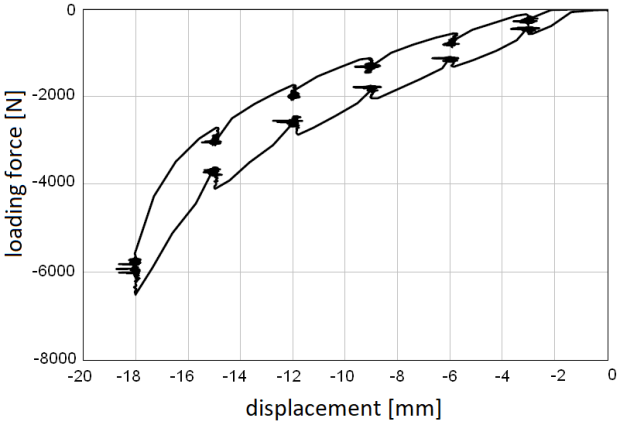

Figure 8: Dependence of loading force-displacement, measuring of gradual relaxation, specimen 2

4. Mathematical model of material

The Mooney-Rivlin model, designed by Melvin Mooney and Ronald S. Rivlin in 1952 [9], was chosen to describe the used rubber. Free energy is decomposed into the equilibrium part, which is responsible for the elastic behavior of the material and to the configuration of free energy, which has a viscous response. The compressible material is assumed and therefore the equilibrium part of a

Helmholtz's free energy is further decomposed according to [5] into the volumetric and distortion part (equation (1)).

$$\Psi\left(\mathbf{C},\boldsymbol{\Gamma}_1,\mathrm{L}\ ,\boldsymbol{\Gamma}_m\right)= \\ =\Psi_{VOL}^{\infty}\left(J\right)+\Psi_{ISO}^{\infty}\left(\overline{\mathbf{C}}\right)+\sum_{\alpha=1}^{m}\Upsilon_{\alpha}\left(\overline{\mathbf{C}},\boldsymbol{\Gamma}_{\alpha}\right),\ \overline{\mathbf{C}}=J^{-2/3}\mathbf{C} \tag{1}$$

The first two members in the eq. 1 describes an equilibrium state when $t\to\infty$, the third member is a dissipative potential, which depends on a modified right Cauchy-Green strain tensor $\overline{\mathbf{C}}$ and on an internal deformation variables $\boldsymbol{\Gamma}_{\alpha}$. The variable J is determinant of a deformation gradient tensor $\mathbf{F}$ and $\mathbf{C}=\mathbf{F}^T\mathbf{F}$ is a right Cauchy-Green strain tensor. A second Piola-Kirchhoff stress tensor $\mathbf{S}$ is a sum of three parts - equilibrium volumetric stress $\mathbf{S}_{VOL}^{\infty}$,

equilibrium isochoric stress $\mathbf{S}_{ISO}^{\infty}$ and a sum of viscosity parts of stress (overstress) $\mathbf{Q}_{\alpha}$ (2)

$$\mathbf{S}=2\frac{\partial\Psi\left(\mathbf{C},\boldsymbol{\Gamma}_1,\mathrm{L}\ ,\boldsymbol{\Gamma}_m\right)}{\partial\mathbf{C}}=\mathbf{S}_{VOL}^{\infty}+\mathbf{S}_{ISO}^{\infty}+\sum_{\alpha=1}^{m}\mathbf{Q}_{\alpha}\ . \tag{2}$$

The evolution equations (3) for the internal variables $\mathbf{Q}_{\alpha}$, which are types of a second Piola-Kirchhoff strain tensor, result from a Wiechert's rheological model of material (figure 9).

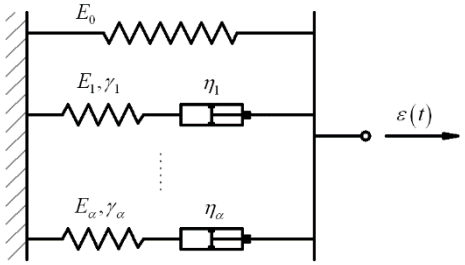

Figure 9: Wiechert's rheological model of material

$$\begin{aligned}
&\dot{\mathbf{Q}}_{\alpha}+\frac{\mathbf{Q}_{\alpha}}{\tau_{\alpha}}=\dot{\mathbf{S}}_{ISO\,\alpha}\ ,\\
&\dot{\mathbf{S}}_{ISO\,\alpha}=\beta_{\alpha}^{\infty}\,\dot{\mathbf{S}}_{ISO}^{\infty}\left(\overline{\mathbf{C}}\right),\\
&\dot{\mathbf{S}}_{ISO}^{\infty}\left(\overline{\mathbf{C}}\right)=\frac{\partial\mathbf{S}_{ISO}^{\infty}}{\partial\mathbf{C}}\dot{\mathbf{C}}=Ł_{ISO}\dot{\mathbf{E}},\\
&Ł_{ISO}=2\frac{\partial\mathbf{S}_{ISO}^{\infty}}{\partial\mathbf{C}}=2\frac{\partial\mathbf{S}_{ISO}^{\infty}}{\partial\overline{\mathbf{C}}}\frac{\partial\overline{\mathbf{C}}}{\partial\mathbf{C}}
\end{aligned} \tag{3}$$

In the equations (3) $\beta_{\alpha}^{\infty}\in\left(0,\infty\right)$ is a dimensionless factor of deformation energy, τ_{α} is a relaxation time, $Ł_{ISO}$ is an isochoric part of an elastic tensor in the Euler description and $\dot{\mathbf{E}}$ is an material tensor of deformation rate (4)

$$\dot{\mathbf{E}}=\frac{1}{2}\left(\overset{\circ}{\mathbf{F}}^T\mathbf{F}+\mathbf{F}^T\dot{\mathbf{F}}\right). \tag{4}$$

Assuming a slightly compressible material, it is possible to choose the volumetric and isochoric (Mooney-Rivlin model) part of the Helmholtz free energy function in the form (5)

$$\Psi_{VOL}^{\infty}\left(J\right)=\frac{1}{d}\left(J-1\right)^2,\Psi_{ISO}^{\infty}\left(\overline{\mathbf{C}}\right)= \\ =c_1\left(\overline{I}_1-3\right)+c_2\left(\overline{I}_2-3\right) \tag{5}$$

where $\overline{I}_1$ and $\overline{I}_2$ are the modified invariants of the strain tensor $\mathbf{C}$. The time-dependent response of the material was modeled through $\alpha=3$ relaxation processes with relevant relaxation times τ_{α} and coefficients β_{α}^{∞}. Parameters of model $c_1, c_2, d, \tau_{\alpha}, \beta_{\alpha}^{\infty}$ was determined by a nonlinear regression from the measured quantities. Their values, rounded to four digits, are shown in tables 2 and 3.

d [MPa^{-1}]	c_1 [MPa]	c_2 [MPa]
0.01783	0.4171	1.023

Table 2: Values of the elastic constants

β_1 [-]	β_2 [-]	β_3 [-]	τ_1 [s]	τ_2 [s]	τ_3 [s]
0.1308	0.08669	0.1433	3011	55.84	1.548

Table 3: Values of the viscoelastic parameters

5. Modelling of the segment using FEM

The vibroisolation segment was modelled by a CAD software and meshed using eight-node elements (figure 10). For the material description is used Mooney-Rivlin hyperelastic model with the material parameters c_1, c_2, d . The segment is gripped between two ideal stiff contact surfaces and loaded by forces in two steps (loadstep), corresponding with a table 4.

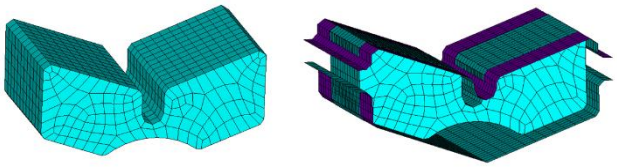

Figure 10: FEM model of the vibroisolation segment and contact surfaces

	F_x [N]	F_y [N]	F_z [N]
loadstep 1	0	1900	0
loadstep 2	0	2400	300

Table 4: Values of the loading forces in the FEM analysis

The analysis was performed using the FEM software ANSYS. Results of the analysis are shown on figures 11 to 13.

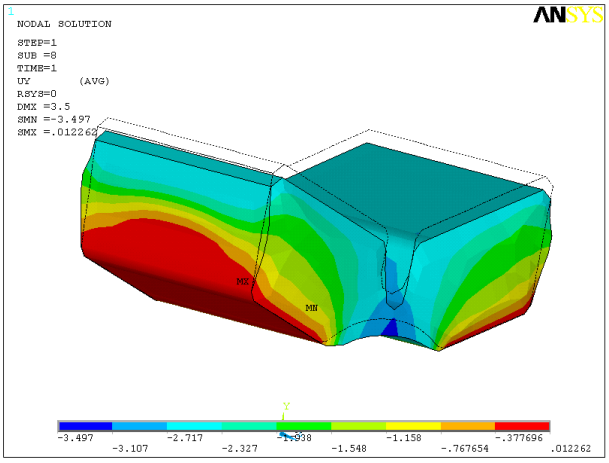

Figure 11: Displacement in the loading force direction, loadstep 1

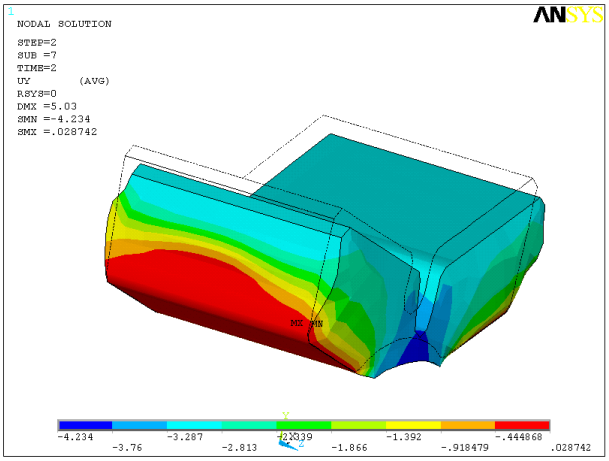

Figure 12: Displacement in the loading force direction, loadstep 2

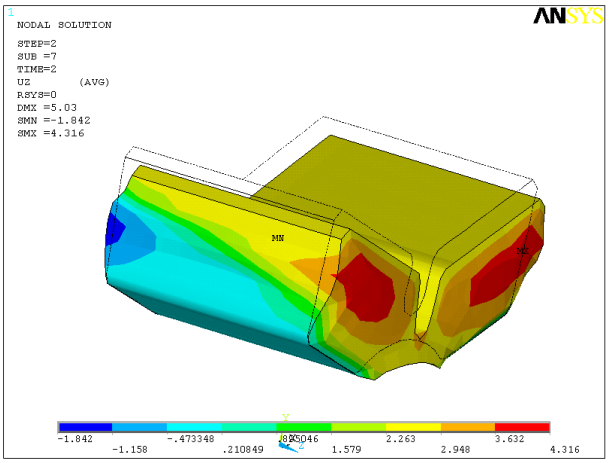

Figure 13: Displacement in the direction of shear, loadstep 2

6. Conclusion

The phenomenological material model based on the theory of viscoelastic bodies was used for the studied filled rubber. Parameters of this model were determined using nonlinear regression methods. The research results can be used for the analysis of rubber-made machine parts using the finite element method, which is very important for the optimal design of machines and equipment.

Acknowledgements

The work was made possible by a Center of Engineering Research & Development, VÚTS, a.s. Liberec.

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Session: Applied Informatics

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MEASUREMENT OF PERFORMANCE AND TESTING OF MOBILE NEXT GENERATION ACCESS NETWORK

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Abstract: *With the exponentially growing number of mobile devices and the number of end mobile terminals that require higher quality access networks increases the need to monitor coverage and mobile network performance. This paper focuses on measuring radio and data mobile access networks in different locations. It represents a design how to test the performance of the mobile network.*

Keywords: *NGN/NGA, performance, TCP/IP, latency, throughput.*

1. Introduction

In last few years were conducted more intensive strengthening of new generation networks in the Czech Republic, which led to decreasing of base stations mostly by coverage reduction for EDGE networks. Methodology for mobile networks parameters monitoring and evaluation were modify in 2007. The main focus was on individual monitoring and radio-communication networks of electronic communications, where is focus on end user and their internet access. New methodology is consistent with previous regulations and norms as well as application of computational formulas.

1.1 Infrastructure for measurement

Measurement is conducted on measuring server to the mobile terminal, which is in the role of end mobile participant. The measuring server must be sufficiently dimensioned from the computing output point of view as well as the connection itself into Internet network. Limitations in measurement can occur by wrong dimensioning of network and output features. Own autonomous system (AS) of regulatory office CTO, which own national regulator, is used for appropriate network location. The own autonomous system ensures neutrality within access into peering node NIX.cz. Wiring diagram for NIX.cz nodes with a transit connection, can be found below.

In case of mobile access network exists in contrast to fix network need ti be more aware of higher number of possible scenarios, where the radio mobile network is often perceived in different terrain conditions. The measurement is conducted in driving mode or stationary. Driving measurement is carried out during driving and each gain parameters are structured into measuring intervals and each measuring quadrants. This first type of measurement is performed according to recommended maximum speed, which is for city 40 km per hour and highway or speed communication is 100 km per hour. For measuring within railway corridor is not speed defined in updated methodological approach. Driving measurement is dedicated mostly for city, highway and other roads measurement, coverage of railway corridors, control of conditions fulfillment within frequency auctions as well as solving complaints from end customers [1].

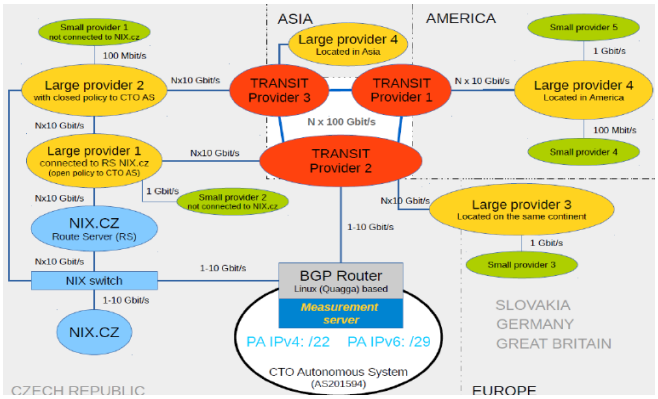

Figure 1: Diagram for NIX.cz nodes with a transit connection, can be found below

Stationary measuring is conducted during different daytimes and on chosen position, which will take place for at least 600 measuring intervals, that is approximately 10 minutes. This type of measurement is determined mostly for solving of end customer complaints, control of conditions fulfillment within frequency auctions and long-term monitoring.

Above mentioned types of measurement can be repeated. Mainly in cases, where was found out problem in certain location in previous statement. In case of highway, speed road or railway corridor will be measurement carried out in both directions of each route in order to evaluate more accurately all parameters. The measurement zone, so called quadrants, will be chosen with special regard to coverage as biggest number of residents as possible in each location. It is necessary to pay attention mostly to problem locations in case of dispute or conflict.

1.2 Tool for measurement of mobile network

In order to test all features and parameters of mobile network is used SwissQual terminal. The SwissQual verifies transmission in GSM and LTE network. Furthermore, benchmarking of performance within end user, use of analytical tools for measurement of the frequency spectrum, signalization during transmission in mobile data network and name identification of mobile cells [2].

2. Measurement parameters

Parameters, which are measured, are download, upload and delay, where set up is based on actual methodological approach for fixed and mobile networks published by the regulatory office. The download measurement and upload measurement are separately or at the same time according to chosen scenario, but always delay measurement is conducted in parallel. As integral part within measurement is necessary to measure state of radio signal. Transmission feature is depended on radio signal, which can be influenced by several factors [2].

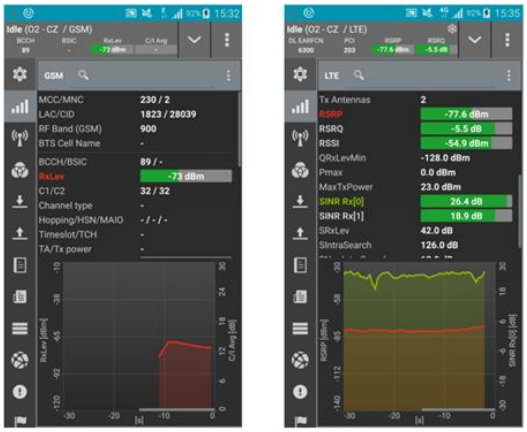

Figure 2: Measuring of GSM network (left) and LTE network (right)

The most important is definitely interference in each frequency. Because of it, is necessary to conduct control of frequency spectrum and carry out radio parameters measurements. In order to measure radio parameters is appropriate to state and remind limit values for each technology as well as respective bands. All essential values for radio parameters are stated in table below [3].

Table 1 Limit values are related to antenna high 1,5 m with exception of railway corridor, where is antenna high 4,5 m.

	Frequency			*Frequency*
Typ	*Band*	*Settlement*	*Typ*	*Band*
	[MHz]	*[dBm]*		*[MHz]*
LTE	*800*	*-109*	*LTE*	*800*
LTE	*900*	*-109*	*LTE*	*900*
GSM	*900*	*-93*	*GSM*	*900*
LTE	*1800*	*-107*	*LTE*	*1800*
GSM	*1800*	*-91*	*GSM*	*1800*
UMTS	*2100*	*-86*	*UMTS*	*2100*
LTE	*2100*	*-106*	*LTE*	*2100*
LTE	*2600*	*-105*	*LTE*	*2600*

3. Measurement of data speed

All measurement of data parameters (not only speed) can be conducted against measurement server of CTO. All features are defined as well as measurement characteristics for type of measurement during download via HTTP protocol, where used stationary measurement for measuring data speed only for LTE network is. The same is carried out for driving measurement. Application offers output graphical representation already during measurement, where is shown transmission within LTE network (Sched Thrpt, PDSCH Thrpt). Furthermore, is appropriate to display graph for better understanding in time even with maximum, minimum and average calculation [3].

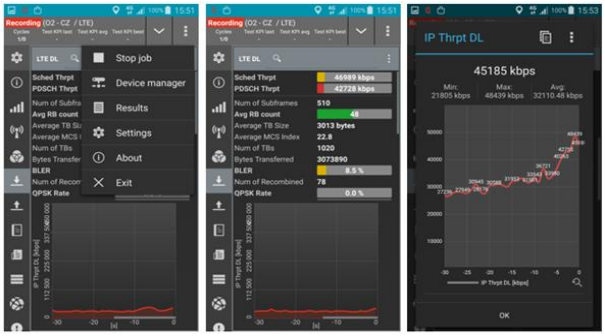

Figure 4: Measurement of data speed

4. Response measurement

For response measurement is used ping test, which enables evaluate connection functionality between measuring server and measuring terminal. The set-up is again based on regulatory office recommendations. In the test must be carry out at least 10 measurement consecutively and based on that will be calculated average. Picture number six represents outcomes of each test as well as final calculation of maximum, minimum and average values. Sometimes can be value of the first measurement absurdly high and does not at all correspond to the other measured values. In that case, is appropriate to ignore the first value and average calculate without it. Because of it, is Job set up for 11 measurements [4].

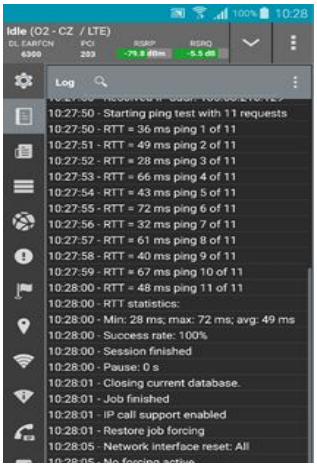

Figure 5: Measurement of response

Measurements are in next step exported and it is possible to make further adjustments for another processing and interpretation. The network connections, which have enormous transmission capacity and high bi-directional delay, is caused by the transmission of large amounts of data. These lines are called as „long fat pipies“ and it is appropriate to use adjusted protocols or change TCP window training.

6. Conclusions

The mobile networks are key access network into internet. The total end-user requirements for transmission are constantly rising and these requirements are shifted into operator, which must scaling its infrastructure and be flexible in reactions on growing demand for multimedia transmissions, which bring higher data difficulty. With this content trend as well as arriving of large number of mobile as well as stationary users grows necessity to control transmission parameters conducted by national regulator. Also it is necessary to focus on protection of service end-user.

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SOLVING NP-COMPLETE PROBLEM USING FORMAL METHOD EVENT-B

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Abstract: *This paper brings a solution for optimization problem using formal method event-B. As we knew recall of the devide-and-conquer method partitions the problem into subproblems,solve the subproblems and combine the solutions to solve the original one.If subproblems are not independent,i.e subproblems share subsubproblems,then a divide-and-conquer algorithm repeatedly solves the common subsubproblems,thus,it does more work than necessary.Better soluton is dynamic programming,The idea compute the solutions of the subsub problems once and store the solutions in a table,so that they can be reused(repeatedly)later,so we trade a space for time. In this paper we will show the way to develop mathematical model using Event-B method to solve Knapsack problem.*

Keywords: *Event-B, machine, context, knapsack*

1. Introduction

Because we will use some of the algorithm complexity concepts in this paper, we will first explain some basic concepts related to this area. To begin with, we will inaccurately indicate the significance of some of them. The terms that are used are polynomial complexity and exponential complexity.

Generally, complexity is a function that expresses "the maximum time that algorithm calculation will take with any input of length n". The input length is a relatively individual problem for each algorithm. For example, if there is an array on the input of algorithm,the input length will be the length of this array. However, if the algorithm has one number at the input, the length of the input will be the size of this number.

2. Complexity of algorithms

A polynomial complex algorithm means an algorithm for which there exists a polynom $P(n)$, where n is the length of the input, such that for each input of length n the calculation time is less than or equal to $P(n)$.

Exponentially complex algorithm means an algorithm A for which the following applies. For any function $E\ (n)$ such that the calculation length of algorithm A over the input of length n is less than or equal to $E\ (n)$, so : There is a real constant C such that infinitely many natural numbers n apply to the relationship $C.2^n \leq E(n)$.

2.1 Polynomial and exponential algorithms

The distinction between polynomial and exponential algorithms is well-founded. While with polynomial algorithms we can solve problems with "long" inputs, in exponential algorithms we would not even reach the end of the results with relatively "short" inputs. For comparison, consider a computer that is capable of doing one operation in 10^{-8} seconds. In table 1, you can compare how fast the input time increases with the algorithm (i) that takes $n^{\,2}$ steps and the algorithm (ii) that performs 2^n. The data are in seconds. For comparison, we added in the last line recalculations data in seconds for 2^n to other units.

Table 1 Algorithms comparison

Input length	1	2	10	20
n^2	10^{-8}	4.10^{-8}	10^{-6}	4.10^{-6}
2^n	2.10^{-8}	4.10^{-8}	$1{,}024.10^{-5}$	0,01

Table 2 Algorithms comparison

Input length	35	50	100
n^2	$1{,}225{,}10^{-8}$	$2{,}5.10^{-5}$	10^{-2}
2^n	343,6	$11{,}259.10^{6}$	$1{,}2676.10^{22}$
	5 min 46 sec	130 days	4.10^{14} years

As can be seen from the data presented in the table, while the difference in calculus time is almost indistinguishable at the input of length 20 by the human senses, the algorithm (ii) lags very behind the algorithm (i) at the input of the length 35. And while the running time of the algorithm (i) will still be unavoidable at the input of length 100, the completion of the algorithm (ii) with the same length of input is unlikely to occur. Therefore, we always try to avoid exponentially complex algorithms when solving problems, even at the cost of a certain loss of accuracy. One of the algorithms that we can replace an exponentially complex algorithm with a certain loss of accuracy is the genetic algorithm.

2.2 The NP-complete problems

The NP-complete problems are a large number of problems, for which solutions have not yet found better algorithms than exponential complexity algorithms. These problems can be found in the literature as NP-complete. In this paper we will not devote space to the theory of NP-

complete problems.. That's why we just suggest some basic features:

I. Only algorithms that have exponential complexity are found to solve these problems, and there are generally no faster algorithms expected to exist.
II. If a polynomial complexity algorithm were found to calculate any NP of a complete problem, then for all NP-complete problems there would have been a polynomial complexity algorithm that would solve them. However, such an algorithm has not yet been found.

The problems that belong to this group are very practical in nature. We often encounter real problems in practice, with the NP-complete problem for exampleThe Problem of a Traveling Salesman , Color the chart with three colors and Knapsack problem.

3. Event-B method

Event-B

Event-B is an evolution of the B method, both introduced by Abrial. Event-B employs set theory and first-order logic for specifying software and/or hardware behavior. A big advantage of Event-B is its tool support, offered by the Rodin platform. Using Rodin and its plug-ins, one can create and edit Event-B specifications, verify them using automatic or interactive provers, animate and model check Event-B specifications.

An Event-B specification consists of contexts and machines. A context describes the static part of a system: sets, constants and axioms. A machine uses (sees) the context to specify behavior of a system via a state-based formalism.

Variables of the machine define the state space. Events, which change values of these variables, define transitions between the states. An event consists of guards and actions, and can have parameters. An event can occur only when its guards are true, and as a result of the event its actions are executed. The properties of the system are specified as invariants, which should hold for all reachable states.

The properties are verified via proving automatically generated proof obligations and/or via model checking.
The attractive simplicity of Event-B is enhanced by techniques such as shared event composition and generic instantiation, which support scalability and reuse of Event-B specifications.

3.1 The Knapsack problem

The problem of a Knapsack is, however, one of a large number of problems, for which solutions have not yet found better algorithms than exponential complexity algorithms.

The basic version of the Knapsack problem is as follows:

I. We have a list of objects, each of which is given its size C_i Next, we have the size of the Knapsack C.
II. Our task is to put the entered items into the Knapsack of those who enter it (it means the sum of the volumes C_i is smaller than C) and the sum of their volumes is as large as possible.
III. The following smiley interpretation is often used for this problem. The thief comes into the apartment with a Knapsack in his hand. Because he's in a hurry, he's only gotten the time to get things in his bag. Its aim is to take away the tightest (the most complete) Knapsack.

There are many modifications for this assignment. One of them is as follows:

I. We have a Knapsack of a certain capacity (volume) C. We also have n items. Each (i th) of these items has its volume C_i and value P_i. Our task is to stack from the given subjects in the those who Knapsack enter it "(That means the sum of the volumes C_i is less than C or equal C) and the sum of their prices is the largest.
II. This entry is slightly more general than the original version. If we select items as their prices are equal to their volumes, we will get the original assignment.

For a better understanding of the problem, we give an example. Let's have a Knapsack capacity of 30 and five items whose parameters are listed in Table 2.

Table 3 Articles for the Knapsack

No.	*0*	*1*	*2*	*3*	*4*
C_i	20	10	15	15	25
P_i	170	200	181,3	160	250

The answer to our example will be the containing Knapsack items 1 and 2. These items do not fill the Knapsack, but the sum of the prices is greatest for all the combinations of items that can be stacked in the Knapsack. There is no even the most expensive item 4, because no item will be added to it anymore. Similarly, there is no combination of items 0, 1 or 2, 3 that will completely fill the Knapsack , but the sum of their prices will be lower than the combination of 1, 2.

This example, thanks to a simple insight into 5 strings, could be solved quickly. In general, solving this problem is more complicated when we have more items and a larger knapsack capacity that does not exceed the sum of the volumes of all items. There are some special cases where problem solving is simple (polynomial algorithm). For the general case, however, only algorithms with exponential complexity have been found. The simplest but most time-consuming algorithm for finding a solution is to compare all possible combinations of items that can be stacked in the Knapsack. There are somewhat improved strategies, but all of them have exponential complexity.

3.2 Knapsack model in Event-B

```
machine KnapsackMac
variables n // Number of Items
          Capacity // Capacity of Knapsack
          Values // Values of items
          Weights // Weights of items
          I // Rows of Array from 0 to n
          C // Columns of Array from 0 to Capacity
          KIndex // Index of Array
          K // Array 2D
          Result // Final Result
```

Figure 1: Knapsack model – Event-B (variables)

```
invariants
  @inv1 n∈ℕ
  @inv2 Capacity∈ℕ
  @inv3 Values∈0‥n-1⇸ℕ
  @inv4 Wieghts∈0‥n-1⇸ℕ
  @inv5 I⊆0‥n
  @inv6 C⊆0‥Capacity
  @inv7 KIndex ⊆ I↔C
  @inv8 K∈KIndex⇸ℕ
  @inv9 Result∈ℕ
```

Figure 2: Knapsack model – Event-B (invariants)

```
events
  event INITIALISATION
    then
      @act1 n≔0
      @act2 Capacity≔0
      @act3 Values≔∅
      @act4 Weights≔∅
      @act5 I≔∅
      @act6 C≔∅
      @act7 KIndex≔∅
      @act18 K≔∅
      @act9 Result≔0
  end
```

Figure 3: Knapsack model – Event-B (initialisation)

```
event KnapSack1
  any i w x
  where
    @grd1 i∈I
    @grd2 w∈C
    @grd3 x∈KIndex
    @grd4 i=0 ∨ w=0
    @grd5 x={i↦w}
  then
    @act1 K(x)≔0
end

event KnapSack2
  any i w x x1 x2
  where
    @grd1 i∈I
    @grd2 w∈C
    @grd3 i≠0 ∧ w≠0
    @grd4 Weights(i-1)≤w
    @grd5 x∈KIndex ∧ x1∈KIndex ∧ x2∈KIndex
    @grd6 x={i↦w}
    @grd7 x1={i-1↦w-Wieghts(i-1)}
    @grd8 x2={i-1↦w}
    @grd9 Values(i-1)+K(x1)≥K(x2)
  then
    @act1 K(x)≔Values(i-1)+K(x1)
end
```

Figure 4: Knapsack model – Event-B (events)

```
event KnapSack3
  any i w x x1 x2
  where
    @grd1 i∈I
    @grd2 w∈C
    @grd3 i≠0 ∧ w≠0
    @grd4 Weights(i-1)≤w
    @grd5 x∈KIndex ∧ x1∈KIndex ∧ x2∈KIndex
    @grd6 x={i↦w}
    @grd7 x1={i-1↦w-Wieghts(i-1)}
    @grd8 x2={i-1↦w}
    @grd9 Values(i-1)+K(x1)<K(x2)
  then
    @act1 K(x)≔K(x2)
end

event KnapSack4
  any i w x x1
  where
    @grd1 i∈I
    @grd2 w∈C
    @grd3 i≠0 ∧ w≠0
    @grd4 Weights(i-1)>w
    @grd5 x∈KIndex ∧ x1∈KIndex
    @grd6 x={i↦w}
    @grd7 x1={i-1↦w}
  then
    @act1 K(x)≔K(x1)
end

event GetResult
  any i w x
  where
    @grd1 i=n
    @grd2 w=Capacity
    @grd4 x∈KIndex
    @grd3 x={i↦w}
  then
    @act1 Result≔K(x)
end
end
```

Figure 5: Knapsack model – Event-B (events)

3.3 Statistics

Table 4 Proving statistics Event-B

Elemnt Name	*Total*	*Auto*	*Manual*	*Rev.*	*Undis.*
Knapsack	25	25	0	0	0
KnapsackMac	25	25	0	0	0

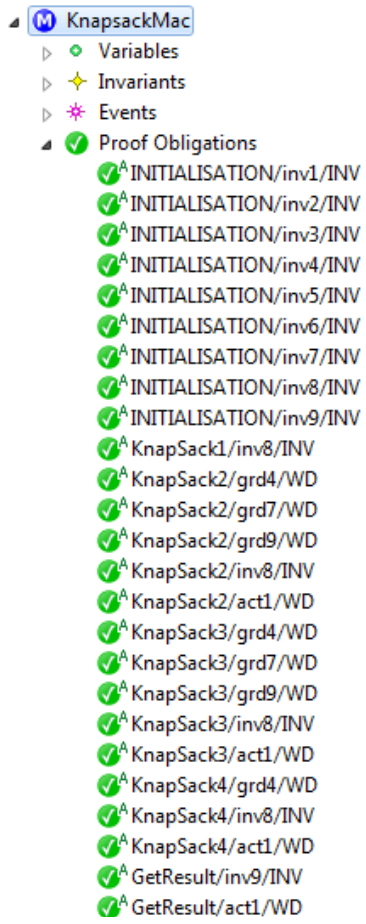

Figure 6: Prooving elements – Event-B tool

4. Discusion

We have shown that there are many methods solving NP-complete problems,but each is much suitable for one group of problems than the others,where formal method Event-B is suitable for any, So we can say, Event-B is a formal method that is used for specifying and reasoning about complex systems and in this paper our problem is translated into the Event-B notation to verify required properties, where event-B allows us to define a kind of modeling methodology by write the correct mathematical notions.

4. Conclusion

Formal method is an important concept and we have been covered in many papers. And in this paper we offered Event B as formal method to solve NP-complete problems and as a case study we have choose Knapsack problem, searching proved solution what we achieved.

Our paper provides abstract model of Knapsack problem and we can get optimal solution by refinement of abstract model, where the development of an Event-B model goes through two stages; abstraction and refinement, the abstract machine specifies the initial requirements of the system and refinement is carried out in several steps - with each step adding more detail to the system, As well as the Rodin tool offers reactive environment for constructing and analyzing models as do most modern integrated development environments, and provides integration between modeling and proving whereas this is important feature for the developers to focus on the modeling task without switch between different tools to check proving in same time.

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CUTTING-PLANE METHOD IN MODELING OF INFORMATION SYSTEMS

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Abstract: *The scientific article considers features of designing of information systems. The mathematical model of information system is developed. The optimum decision of mathematical model is defined by cutting-plane method. The mathematical model allows to lower financial expenses at designing information systems of the organizations.*

Keywords: *Mathematical model, information system, cutting-plane method, algorithm, optimum decision*

1. Introduction

An enterprise today is a complicated dynamic system focused on performing a set of particular tasks which characterize efficiency of information system functioning. Improvement of information system functioning can take place provided up-to-date technical equipment, software, economic and mathematical models and optimization methods are used [1, 2].

2. Statement of a problem

The mathematical model of information system can be stated in the following way: from among the companies providing satellite Internet services within the territory of the Russian Federation it is necessary to choose a satellite Internet provider with the maximum net present value (maximum total cost of capital) and meeting financial restrictions.

3. Development of mathematical model

Let X_1 - share of financing of the project NTV-plus, X_2 - share of financing of project Europe On Line, X_3 - share of financing of project Astra Network, X_4 - share of financing of project Satpro, X_5 - share of financing of project Network Service. X_i - binary variables.

The integer mathematical model looks like

$$\max \leftarrow Z = 1.527270 * X_1 + 0.741239 * X_2 + 1.374394 * X_3 + 0.145110 * X_4 + 0.530312 * X_5$$

subject to

$$\begin{cases} 5{,}4 * X_1 + 3.2 * X_2 + 2.931 * X_3 + 6.286 * X_4 + 5.9 * X_5 \le 6{,}5 \\ 2.006437 * X_1 + 1.5 * X_2 + 3.000547 * X_3 + 3.000575 * X_4 + 3.2 * X_5 \le 3{,}0 \\ 2.5 * X_2 + 2.0 * X_3 + 1.6 * X_5 \le 3{,}0 \\ 0.881832 * X_2 + 1.186 * X_5 \le 1{,}5 \\ X_1, X_2, X_3, X_4, X_5 \ge 0 \\ X_1, X_2, X_3, X_4, X_5 - \text{intergers} \end{cases}$$

The cutting-plane's algorithm contains stages:

The stage 1. The integrity is ignored, the simplex method is found the optimum plan. If the decision fractional, transition to 2 stage.

Stage 2. The decision of the expanded problem.

Table 1 The initial Jordan's table

Basis	1	- X_1	- X_2	- X_3	- X_4	- X_5
X_6 =	6.5	5.4	3.2	2.931	6.286	5.9
X_7 =	3.0	2.006	1.5	3.0005	3.000	3.2
X_8 =	3.0	0.0	2.5	2.0	0.0	1.6
X_9 =	1.5	0.0	0.881	0.0	0.0	1.186
Z=	0	-1.527	-0.741	-1.374	-0.145	-0.53

The first iteration is resulted in table 2.

Table 2 The first iteration

Basis	1	- X_6	- X_2	- X_3	- X_4	- X_5
X_1 =	6.5/5.4	1/5.4	3.2/5.4	2.931/5	6.286/5.	5.9/5.4
X_7 =	0,584	-0,37	0,311	1,911	0,664	1,007
X_8 =	3,0	0	2,5	2,0	0	1,6
X_9 =	1,5	0	0,8818	0	0	1,186
Z=	1,838	0,28	0,163	-0,545	1,632	1,138

The optimum decision of a continuous problem is resulted in table 3. Transition to the second stage of cutting-plane's algorithm.The basic variable gets out X_3 with the greatest fractional part: $\{X_3\} > \{X_1\}$, $\{0.305961\} > \{1.037635\}$, $0.305961 > 0.037635$. The equation is worked out for variable X_3. The expanded problem and the third iteration are presented in table 4 and table 5.

Table 3 The optimum decision of a continuous problem The second iteration

Basis	1	- X_6	- X_2	- X_7	- X_4	- X_5
X_1 =	1,037	0,290	0,504	-0,283	0,975	0,806
X_3 =	0,305	-0,194	0,162	0,523	0,347	0,527
X_8 =	2,388	0,388	2,174	-1,046	-0,695	0,545
X_9 =	1,5	0	0,881	0	0	1,186
Z=	2,00	0,17	0,252	0,285	1,822	1,425

Table 4 The expanded problem with the first additional restriction

Basis	1	- X_6	- X_2	- X_7	- X_4	- X_5
X_1 =	1,03	0,290	0,504	-0,283	0,975	0,806
X_3 =	0,30	-0,194	0,16	0,523	0,347	0,527
X_8 =	2,388	0,388	2,174	-1,04	-0,695	0,545
X_9 =	1,5	0	0,881	0	0	1,186
X_{10} =	-0,305	0,194	-0,162	-0,523	-0,347	-0,527
Z=	2,00	0,17	0,25	0,285	1,822	1,425

The optimum nonintegral decision is resulted in table 6. The expanded problem with the second additional restriction is presented in table 7. The fifth iteration is resulted in table 8. The expanded problem and the optimum integer decision are presented in table 9 and table 10.

Table 5 The third iteration

Basis	1	- X_6	- X_2	- X_7	- X_4	- X_{10}
X_1 =	0,569	0,588	0,255	-1,084	0,443	1,529
X_3 =	0	0	0	0	0	1
X_8 =	2,071	0,589	2,006	-1,587	-1,055	1,034
X_9 =	0,811	0,437	0,515	-1,176	-0,782	2,249
X_5 =	0580	-0,368	0,308	0,992	0,659	-1,896
Z=	1,17	0,70	-0,187	-1,129	0,881	2,704

Table 6 The optimum nonintegral decision. The fourth iteration

Basis	1	- X_6	- X_2	- X_5	- X_4	- X_{10}
X_1 =	1,203	0,185	0,592	1,092	1,164	-0,542
X_3 =	0	0	0	0	0	1
X_8 =	3	0	2,5	1,6	0	-2
X_9 =	1,5	0	0,881	1,186	0	0
X_7 =	0,584	-0,371	0,311	1,00	0,664	-1,911
Z=	1,83	0,28	0,163	1,138	1,632	0,545

Table 7 The expanded problem with the second additional restriction

Basis	1	- X_6	- X_2	- X_5	- X_4	- X_{10}
X_1 =	1,203	0,185	0,592	1,092	1,1640	-0,542
X_3 =	0	0	0	0	0	1
X_8 =	3	0	2,5	1,6	0	-2
X_9 =	1,5	0	0,881	1,186	0	0
X_7 =	0,584	-0,371	0,311	1,007	0,664	-1,911
X_{11} =	-0,203	-0,185	-0,592	-0,092	-0,164	0,542
Z=	1,838	0,28	0,16	1,138	1,632	0,545424

Table 8 Cutting off of a fractional part of variable x_1. The fifth iteration

Basis	1	- X_6	- X_{11}	- X_5	- X_4	- X_{10}
X_1 =	1	0	1	1	1	0
X_3 =	0	0	0	0	0	1
X_8 =	2,14	-0,781	4,21	1,209	-0,692	0,289
X_9 =	1,19	-0,27	1,488	1,048	-0,244	0,807
X_7 =	0,47	-0,46	0,524	0,959	0,578	-1,62
X_2 =	0,34	0,312	-1,68	0,156	0,276	-0,91
Z=	1,78	0,231	0,276	1,112	1,587	0,695

Table 9 The expanded problem with the third additional restriction

Basis	1	- X_6	- X_{11}	- X_5	- X_4	- X_{10}
X_1 =	1	0	1	1	1	0
X_3 =	0	0	0	0	0	1
X_8 =	2,14	-0,781	4,21	1,209	-0,692	0,289
X_9 =	1,19	-0,27	1,48	1,048	-0,244	0,807
X_7 =	0,47	-0,46	0,52	0,959	0,578	-1,626
X_2 =	0,34	0,312	-1,68	0,156	0,276	-0,915
X_{12} =	-0,34	-0,312	0,687	-0,156	-0,2768	0,915
Z=	1,78	0,231	0,276	1,112	1,587	0,695

Table 10 The optimum integer decision. The sixth iteration

Basis	1	- X_{12}	- X_{11}	- X_5	- X_4	- X_{10}
X_1 =	1	0	1	1	1	0
X_3 =	0	0	0	0	0	1
X_8 =	3	-2,5	2,5	1,6	0	-2
X_9 =	1,5	-0,88	0,88	1,18	0	0
X_7 =	0,99	-1,500	-0,50	1,196	0,99	-3,0
X_2 =	0	1	-1	0	0	0
X_6 =	1,1	-3,2	-2,2	0,499	0,886	-2,931
Z=	1,52	0,74	0,786	0,996	1,382	1,37

The optimum integer plan $\overline{X}^* = \left\{X_1^*, X_2^*, X_3^*, X_4^*, X_5^*\right\} = \left\{1, 0, 0, 0, 0\right\}$ is presented in table 10. Value of criterion function is equaled 1.52727 [3].

4. Results of research

Results of the lead researches have allowed to draw following conclusions.

1. The integer mathematical model of optimization of the information system is developed, allowing to reduce expenses and terms of designing of information systems and to raise validity of accepted decisions.
2. The optimum decision of an integer problem of optimization of information system is found by the cutting-plane method. For a finding of the integer optimum plan six iterations are executed and three additional restrictions are entered.

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THE ASSESSMENT OF SELECTED PHYSICAL AND CHEMICAL PROPERTIES OF STREET SWEEPING DUSTS FROM BYDGOSZCZ COMMUNE

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Abstract: *The main aim of the study was to investigate selected physical and chemical properties of street sweeping dusts. Soil-like samples were taken from the street sweeper tank in Bydgoszcz. The granulometric composition and pH were similar in analysed street dusts samples. Differences were found in the chemical composition of individual samples. The biggest differences were observed in the content of organic carbon and in the content of bioavailable forms of chromium and manganese. Of the tested heavy metals, iron absorption factor (AF) was the lowest and zinc the highest.*

Keywords: *street dust, heavy metals, dry mechanical cleaning, waste management*

1. Introduction

Progressive urbanisation is a characteristic feature of recent centuries. In parallel with the development of the city, road transport and the development of industry are developing intensively. With the expansion of communication and industry, environmental pollution is growing intensively by increasing the amount of heavy metals [1].

The main source of street dusts (called also road sediment or cleansing residue) are vehicles travelling on the road (wear of brake pads, tires, fumes), compounds used for deicing of streets, industrial and construction dust [2, 3].

Municipal solid waste mainly contains minerals that are common in the soil, but also aromatic hydrocarbons and heavy metals which limit its management. [4]

Heavy metals are among the basic chemical pollutants of all elements of the natural environment in economically highly developed countries. An important problem of heavy metals in the environment is their toxicity and their ability to accumulate in the environment as well as in living organisms [5, 6]. The wide variety of human activities generates pollution and pollution which threatens the natural balance not only at local and regional level, but also on a wider continental and even global scale.

The aim of the present study was to evaluate physical and chemical of street dusts from dry mechanical cleaning of streets to specify its safe management.

2. Material and methods

Material for the study is consist of street dust from mechanical cleaning of streets of Bydgoszcz commune by the Municipal Services Company (53°12′N, 18°01′E; the Kuyavian-Pomeranian Province, central Poland). The waste with a code No. 20 03 03 was cumulated in machinery container [7]. 10 samples of street dust were collected directly from different road sweeper containers in 2016 for the analysis.

Sampled material was treated like soil samples [8]. After preparation, by drying and passing through the 2 mm sieve, sampled material has been analysed by following methods: the texture with the laser diffraction method applying the Mastersizer MS 2000 Malvern analyser, organic carbon content by the Tiurine method, pH in H2O and pH in 1 M KCl measured potentiometrically (ISO 10390). The total concentrations of heavy metals (Zn, Cu, Pb, Ni, Cr, Mn, Fe) were analysed after mineralization of the samples in the mixture of HF and HClO4 according to Crock and Severson method [9] and easily digestible, DTPA-extractable forms, according to Lindsay and Norvell method [10]. The total contents of heavy metals were determined by the method of atomic absorption spectroscopy with the Philips PU 9100X spectrometer.

All the tests were made in three replicates. The paper presents the arithmetic averages and the ranges of results. For the population of the obtained results were calculated a measure of position (arithmetic mean), measures of variability (standard deviation - SD, coefficient of variation - CV%) via the STATISTICA 11 StatSoft program.

3. Results and discussion

Analysed material texture was measured and classified according to Polish Society of Soil Science (PSSS) method [11]. Results showed domination of sand fraction (80,89 – 86.51 wt. %, Table 1). Such a high content of sand particles (2,0 – 0,05 mm) indicates low sorption capacity of the material.

Studied samples were alkaline. Values expressed in pH H_2O and in 1M KCl ranged from 7,41 to 8,04. Typically, soils with significant amounts of sand have a slightly acidic or moderately acidic pH range. The alkalization of the material may be caused by compounds used by municipal services for deicing streets [2]. Lemanowicz et al. obtained similar results by taking samples from the road dust storage site. This suggests that there is no decrease in pH during the storage period [12].

Table 1: The texture and pH of street dusts samples

No. Sample	*Total content of fraction wt. %*			*pH*	
	Sand	*Silt*	*Clay*	*H2O*	*KCl*
1	86,51%	12,56%	0,94%	7,82	7,62
2	84,78%	14,09%	1,14%	8,02	7,68
3	83,28%	15,36%	1,37%	8,04	7,75
4	85,69%	12,72%	1,59%	7,94	7,91
5	84,74%	13,96%	1,31%	7,90	7,55
6	80,89%	17,36%	1,76%	8,01	7,69
7	86,22%	12,62%	1,17%	7,98	7,61
8	83,46%	15,14%	1,42%	7,92	7,38
9	85,91%	13,07%	1,21%	7,98	7,41
10	85,78%	13,10%	1,13%	8,02	7,64
Mean	84,72%	13,99%	1,30%	7,96	7,62
SD	0,02	0,02	<0,02	0,07	0,16
CV, %	2,05	11,11	18,56	0,85	2,04

The content of organic carbon ranged from 0.96 to 5.15 $g \cdot kg^{-1}$, and the CV value (73.07%) was a sign of high variability of the analyzed parameter. The total content of most heavy metals did not exceed the maximum permissible concentrations specified in the standards of the Regulation of the Minister of the Environment [13].

The results for heavy metal content in the studied street dusts were different. The calculated coefficients of variation showed low to medium variability for the total content analysed elements. High total content of copper excludes unprotected areas from potential storage areas of the analysed material. High copper concentration is related to the fact that copper is associated with degradation of brake pads [14]. Other metals in the analyzed samples were present in higher concentrations in comparison with the contents given by Kabata-Pendias and Pendias in surface soil levels [15].

Table 2: The total content of heavy metals and organic carbon in street dusts samples

Element	*Minimum*	*Maximum*	*Mean*	*Median*	*SD*	*CV, %*
Corg [g/kg]	0,96	5,15	2,27	1,28	1,66	73,07
Zn [mg/kg]	20,56	26,1	24,24	24,45	1,5	6,18
Cu [mg/kg]	56,76	91,04	72,48	72,73	10,26	14,16
Pb [mg/kg]	38,85	72,61	54,14	54,1	9,35	17,28
Ni [mg/kg]	25,1	34,04	29,83	29,49	2,49	8,33
Cr [mg/kg]	41,54	49,81	43,86	43,33	2,38	5,43
Mn [mg/kg]	536,63	613,38	576,07	573,39	23,37	4,06
Fe [%]	23,09	29,81	26,51	26,47	2,32	8,74

In analysed material variability of the content of bioavailable heavy metals was big in case of manganese and chromium. In the remaining cases the variability was moderate, and in the case of lead the lowest (table 3). Municipal waste from the sweeping of streets differs in composition depending on their source of its generation Municipal wastes and public squares varied in composition due to their sources [14].

The bioavailability of heavy metals depends on the form of their occurrence, but also on the reaction, organic matter content, oxidative potential, iron and manganese hydroxide content and interaction with other elements.

Average values of bioavailability (AF) for marked heavy metals were in the following order: Zn > Cu > Pb > Mn > Ni > Cr > Fe. Value of Fe_{DTPA} (56.31%) compared to Zn_{DTPA} (14.95 mg/kg) was high. Despite this, the bioavailability of iron (AF 0.02%) compared to zinc (AF 61.91%) was very low. Other researchers also obtained a similar relationship in their research [12, 16].

The AF calculated in the tested samples for copper, zinc and manganese indicates that there was no shortage of available forms of these metals.

Table 3: The content of bioavailable heavy metals in street dusts samples

Parameter	*Zn*	*Cu*	*Pb*	*Ni*	*Cr*	*Mn*	*Fe*
	[mg·kg^{-1}]						*[%]*
Minimum	12,31	2,14	2,79	0,11	0,02	2,96	30,06
Maximum	20,41	9,25	4,15	0,27	0,20	9,75	81,39
Mean	14,95	6,21	3,67	0,19	0,09	5,40	56,31
Median	14,01	5,97	3,79	0,19	0,08	4,60	54,05
SD	2,70	2,08	0,45	0,06	0,06	2,51	14,93
CV, %	18,08	33,45	12,12	30,44	66,57	46,57	26,52
AF (mean)	61,91	8,92	6,98	0,64	0,21	0,93	0,02

4. Conclusions

The research showed that the dominant fraction in the analysed street dusts was the sand fraction, and acidity of the samples was alkaline. The content of organic carbon was different in the samples. In spite of the high contents of copper, analyzed material cannot be stored at protected areas.

Due to increased content of analysed heavy metals (Cu, Pb, Ni, Cr, Mn, Fe) the tested waste may be considered contaminated with these elements at various levels of contamination.

Preliminary studies of selected physical and chemical properties indicate the need to undertake further comprehensive studies in order to investigate the changes that occur during storage of the analysed waste and possible management of the street dusts.

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THE DESIGN OF WATER HEATING INSTALLATION WITH USE OF COMPUTER SUPPORTED DESIGN AND RES SIMULATION

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Abstract: *The basic purpose of the work was to design conceptual installations for the heating of utility water using computer-aided design and simulation of RES. Evaluation of the effectiveness of the installation was carried out on the basis of a comparison of three basic categories of economic, energy and environmental criteria. System designs were made using PolySun software. The results of the analyzes of the designed systems were compared and the best solution was chosen according to previously accepted criteria (highest energy, economic and ecological efficiency). On the basis of literature analysis and simulations, the most important findings and insights from the whole work were identified.*

Keywords: *renewable energy sources, ecological indicator, indicators of ecological effectiveness assessment*

1. Introduction

The expansion of renewable energy bases its pillars on natural assets such as solar radiation, water, wind, geothermal energy and biomass. Recent analyses of energy consumption leave no illusions - the sooner steps are taken to slow down the process of environmental degradation, the greater the chance of saving it and creating a sustainable, effective and at the same time taking into account the very important ecological factors of the model of using energy sources. Already today, measurable effects of the measures taken in the fuel and energy economies of individual countries are visible [8, 10]. The inclusion of renewable energy resources in energy balances clearly results in a significant improvement of such important factors as the increase in the reduction of air pollutant emissions, rational use of energy resources from conventional sources or, for example, energy security [4].

The aim of the study was to prepare conceptual designs of systems for domestic water heating with the use of computer-aided design support and simulation of RES, and then their evaluation in accordance with the adopted criteria (energy, economic and ecological).

2. Material and methods

The analyses were based on the software for computer-aided design and simulation of PolySun. PolySun Simulation Software is a Swiss program used to simulate installations in the field of both conventional and alternative energy, including renewable energy sources. Concepts for hot water heating systems developed with the PolySun programme emissions from RES have been assessed in terms of their energy and environmental efficiency [5, 7].

The energy efficiency of the developed projects was assessed on the basis of the data generated by the PolySun software. PolySun allows you to simulate installations based on the following systems: solar systems thermal (flat-plate, vacuum, heat-pipe, collector), photovoltaic, hybrid PVT, heat pumps (air, ground, water, absorption, adsorption, compressor, passive), fuel cells and power generators it is also possible to simulate the production of emissions from other renewable sources, such as small hydropower plants, wind turbines and waste incineration plants. The unquestionable advantage of the software is universality, accuracy of calculations, clear interface and the possibility of using all possible in one installation and available components [1, 3]. Thanks to its many practical advantages, PolySun is used in a wide range of applications. The project has been successfully carried out by architects, installers, designers, manufacturers, as well as retailers, students and academics. These include the percentage of energy required, the amount of solar energy delivered to the installation, as well as the consumption of fuel and electricity by an additional heat source. The assessment of energy efficiency was also based on the annual energy flow balance. The dimension of the ecological assessment of the systems boils down to the estimation of the level of reduction of CO_2 emission to the atmosphere on an annual basis.

System components

The Vitosol 200 D20 vacuum collector is a highly efficient tube collector built on the principle of a heat pipe - the solar medium does not flow directly through the pipe. Instead, the heating medium changes its focus to gas in the heat pipe and releases heat to the solar medium via a two-pipe heat exchanger

Vitodens 222-W - wall mounted gas boiler with a layered hopper. It has a built-in layered storage tank, made of stainless steel, for 46 litres of water. When hot water is drawn in, the cylinder capacity corresponds to that of a separately set domestic hot water cylinder with a capacity of 150 litres. The Vitocell 300-B 300 l water tank is a vertical DHW cylinder made of stainless steel with two heating coils. The lower heat exchanger is heated by solar collectors and heated by the upper heat exchanger, if necessary, by a gas-fired boiler.

3. Results and discussion

The solution of the domestic hot water heating system is to use a system consisting of two VitoSol vacuum collectors, a 5 kW gas boiler with an internal pump (using the existing boiler in the system) of a 300 l tank, solar circuit pump, regulators and a three-way mixing valve in the assessment of energy efficiency, a simulation was made using the Polysun software, on the basis of which the following indicators can be determined: the amount of solar energy supplied to the installation [kWh], the degree of coverage of energy demand [%], fuel and electricity consumption by an additional heat source - in this case a gas boiler [kWh] - and the annual energy flow balance. Figure 1 shows the amount of solar energy supplied to the installation, which is as follows on an annual basis 2 759 kWh. The highest values are achieved in the spring and summer months from May to August, which is closely related to the sunshine prevailing in these months, while the lowest values - similarly - are achieved in the spring and summer months from May to August, which is closely related to the sunshine prevailing in these months in the autumn and winter months, i.e. from October to February. According to the simulation carried out, an installation consisting of vacuum tube collectors on an annual basis is capable of covering a total energy demand of 65%. The solution of the system consisting of vacuum tube collectors provides thermal energy of 2759 kWh per year. The consumption of fuels and electricity shall not exceed 2 000 kWh. The energy consumption of the pump is practically negligible at 11 kWh.

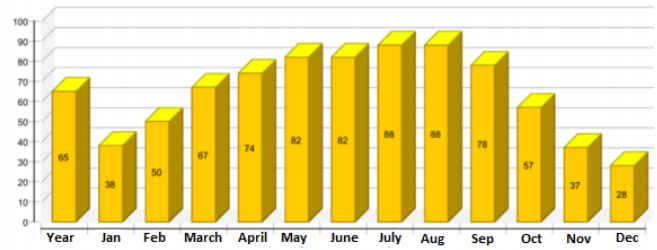

Fig. 1: Quantities of solar energy delivered to the installation - Solution 1 (own research)

Figure 2 shows the degree of solar coverage. The highest percentages can be observed in the months from May to August, while the lowest ones, as before (Fig. 1), are observed in the autumn-winter and early spring months.

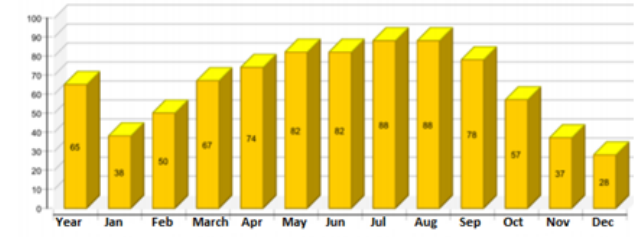

Fig. 2: Percentage coverage of energy demand (own research)

One of the most important aspects of the eco-efficiency assessment of the system for heating domestic hot water with the use of vacuum tube collectors is the degree of reduction of carbon dioxide emissions to the atmosphere, which in this case is 709,9 kg annually. Important are also the savings resulting from exploitation, i.e. fuel savings [natural gas], which amount to a maximum of almost 300 m^3, as well as energy savings of just over three thousand kWh (table 1).

Table 1 Indicators for the assessment of the environmental effectiveness of the system (own research)

Maximum CO_2 reduction	709,9 kg
Total collector area gain	2 758,7 kWh
Maximum fuel economy	291,9 m³ (natural gas)
Maximum energy savings (VDI 6002)	3 065,3 kWh

4. Conclusions

The growing pollution of the natural environment and the inevitable depletion of fossil conventional energy resources seem to be undeniable arguments for reflection on the further development of civilisation. Humanity is facing a very important choice as to how the world's energy sector will continue to function. Renewable energy sources can provide a viable solution to these problems. The development of technology contributed to a drop in prices and availability of an increasing group of RES solutions [11].

At present, the renewable energy model is an important alternative both globally and at the micro level - i.e. for individual consumers. The high operating benefits (in most cases) are offset in a relatively short period of time by higher investment costs [2, 6].

Educating the society in the field of knowledge about renewable energy sources, as well as programmes supporting financial outlays, are undoubtedly a considerable challenge for those in power. Thanks to a wise energy policy, it is possible to make concrete improvements to the functioning of the energy sector and, consequently, to reduce the growing pollution of the natural environment [9, 12].

Therefore, it seems justified to conduct analyses of the possibility of using renewable energy sources for heating utility water in single-family buildings. The paper presents a conceptual design in which the main source of heat was selected RES. The aim of the study was achieved thanks to the review of available solutions for domestic water heating, using energy from renewable sources, and the presentation of the principles of operation and construction of individual components of selected installations. The useful purpose of the work was achieved by the execution of a conceptual design of a system for heating utility water with the use of a computer aided design and simulation of RES, and then their evaluation in accordance with the adopted criteria (energy, and ecological). The projection of the installation was made in order to satisfy the demand for hot utility water for a single-family house located in

Osielsko commune in Kujawsko-Pomorskie Voivodeship. The optimal solution was a system using 16 photovoltaic modules. The system will cover more than 70% of the annual energy demand, provide 3822 kWh of energy (per year) and ensure a reduction of CO_2 emissions into the atmosphere of 2050 kg (per year).

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MATHEMATICAL MODEL FOR CALCULATION OF THE STRENGTH IN KINEMATIC CONNECTIONS OF GEAR PUMP

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Abstract: *In connection with the grant TA 04010579 of the Technology Agency of the Czech Republic, the problem of computer support of the dimensioning of gear pump components is solved. The task is solved based on the requirements of the business sphere. The basic task of the dimensioning process is to determine the external action, i. e. the working and driving, force effects and the internal and external reactions in the kinematic bonds of the mechanism. In the paper, a discrete physical model of the hybrid system consisting of a gear and liquid phase mechanism is proposed. The mathematical model of the system is formulated and its analytical and numerical solution is performed. The model consists of a system of linear non-homogeneous equations. For both cases of a numerical solution, software was created and debugged in the EXCEL and OCTAVE applications. This will allow to deploy this application quickly, user-friendly and repeatedly in the component dimensioning process.*

Keywords: *gear pump, mathematical model, kinematic bonds, force effects*

1. Introduction

The basic task of the process of dimensioning the parts of the mechanisms is to determine the external action, i. e. the working and driving, force effects and the internal and external reactions in the kinematic bonds of the mechanisms. In our case (meaning a single-stage pump with straight teeth), the attention is focused on determining the internal reactions in the gearing, the external reactions in the bearings and the driving torque on the input shaft. This driving torque (which needs to be emphasized especially in relation to the graphical solution) is represented by the torque vector of a pair of forces. The above-mentioned force effects are caused by the action force, or its components, determined by the knowledge of the working pressure at the pump outlet. Members of the mechanisms are considered to by perfectly rigid (including the teeth of the gears and the sliding parts of the bearings) and the fluid is considered to be perfectly incompressible. At this stage of the solution, therefore, the gearing represents an ideal general kinematic pair and the bearings represent rotational kinematic pairs. Due to the symmetry of the mechanisms, the problem is solved in a first stage as a planar task. The mathematical model is completed using the Vector Mechanics. Using the method of the intended cut, the individual parts of the mechanism are released and the removed real bonds are replaced with reactive force effects. For the generated vector force field, we construct the equilibrium conditions, the solution of which we obtain the desired action and reaction, internal and external forces acting on the individual parts of mechanism. The task leads to the solution of the system of linear non-homogeneous algebraic equations, it is solved analytically in closed form, the numerical matrix solution and control graphic solution are performed, too. For both numerical cases, a software solution is developed to allow a designer to quickly and user-friendly repeated application deployment in the component dimensioning process.

2. Determination of external labor force

2.1 Equivalent active areas

When creating a physical model, we replace the real areas enclosing the liquid body enclosed in the active pressure zone, see Figure 1, by imaginary equivalent active areas that generate the corresponding components of the action forces, i. e. the radial component and the peripheral component of the action force. The equivalent area on the pitch roller for the radial force is determined according to the relation (1), the equivalent area for the peripheral force is determined according to the relation (2). It is derived from the nominal profile (J-profile) of the involute gearing. The height *h* of the area for the peripheral force is assumed to be h = 2 m, the length of the arc *s* on the circle is assumed to be equal to half of the pitch $s = \frac{t}{2} = \frac{\pi m}{2}$.

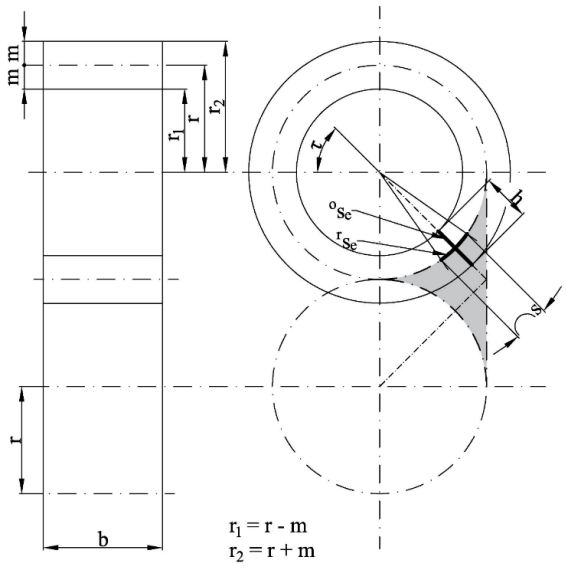

Figure 1: Equivalent active areas

$$^{r}S_e = j \frac{\pi m}{2} b, \quad (1)$$

$$^{o}S_e = i\ 2\ m\ b, \quad (2)$$

$$^{r}S = s\ b = \frac{1}{2} \pi\ m\ b, \quad (3)$$

$$^{o}S = h\ b = 2\ m\ b. \quad (4)$$

2. 2 External action workforce

Due to the symmetry, the task is solved as a flat problem. The pressure field is replaced with a continuous load, the effect of which is replaced by discrete forces at the point (the intersection of the pitch circle and the heights of the active area of the wheel concerned). The median is determined by the angle of the pressure τ. See Figure 2. The radial component bearer of the action force $^{P}F_r$ is determined by this point and point on the axis of rotation. The bearer of the peripheral component $^{P}F_o$ of the action force passes through this point, too, and it is at the same time a tangent of the basic circle. The basic circle is an evolute of the evolvent, and therefore it is necessarily touched by both the elementary vectors of continuous pressure difficulty and their resultants. The size of the action force components to the relevant member are determined according to relations (5), (6).

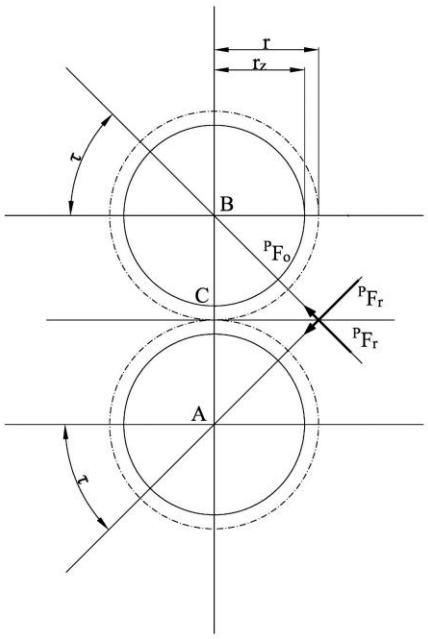

Figure 2: Equivalent workforce radial

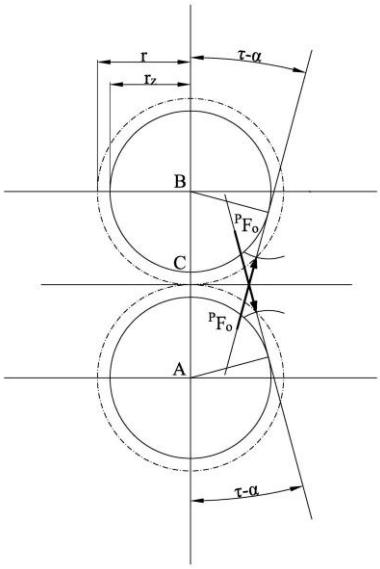

Figure 3: Equivalent workforce peripheral

$$^{P}F_r = p\ \ ^{r}S_e = j \frac{\pi m}{2} b\ p, \quad (5)$$

$$^{P}F_o = p\ \ ^{o}S_e = i\ 2\ m\ b\ p. \quad (6)$$

Among the external action forces, the sought driving torque of a pair forces M_H on the input shaft is included. See Figure 4.

3. Physically mathematical model of the problem

To construct a mathematical model, we use the method of the intended cut or method of release. The vector power field acting on the released input shaft is shown in Figure 4, on the output shaft in Figure 5. Based on equilibrium conditions, equations (7) … (12) are obtained. According to the principle of action and reaction, we obtain an equation (13). From the geometry of the evolvent (Figure 4) the equation (14) flows. Equations represent a system of linear non-homogeneous algebraic equations.

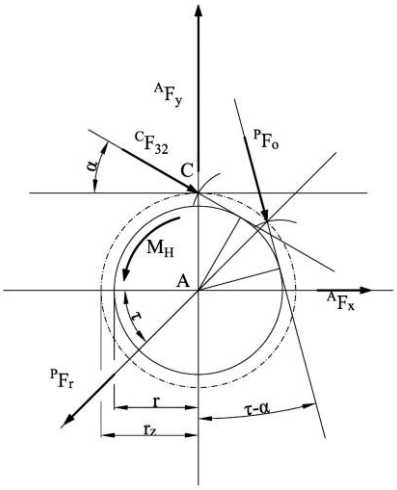

Figure 4: Power action on the drive wheel

$$ {}^{A}F_x + {}^{C}F_{32}\cos\alpha - {}^{P}F_r\cos\tau + {}^{P}F_o\sin(\tau-\alpha) = 0, \quad (7) $$

$$ {}^{A}F_y - {}^{C}F_{32}\sin\alpha - {}^{P}F_r\sin\tau - {}^{P}F_o\cos(\tau-\alpha) = 0, \quad (8) $$

$$ M_H - {}^{C}F_{32}\, r_z - {}^{P}F_o r_z = 0. \quad (9) $$

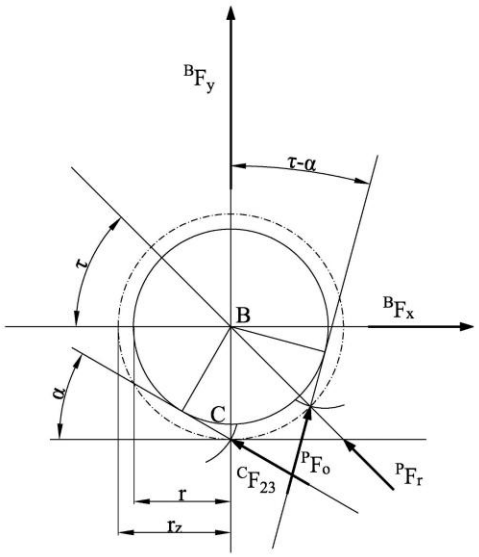

Figure 5: Power action on the driven wheel

$$ {}^{B}F_x - {}^{P}F_r\cos\tau + {}^{P}F_o\sin(\tau-\alpha) - {}^{C}F_{23}\cos\alpha = 0, \quad (10) $$

$$ {}^{B}F_y + {}^{P}F_r\sin\tau + {}^{P}F_o\cos(\tau-\alpha) + {}^{C}F_{23}\sin\alpha = 0, \quad (11) $$

$$ {}^{P}F_o r_z - {}^{C}F_{23}\, r_z = 0, \quad (12) $$

$$ {}^{C}F_{23} = {}^{C}F_{32}, \quad (13) $$

$$ r_z = r\cos\alpha = \frac{zm\cos\alpha}{2}. \quad (14) $$

4. Solving the mathematical model

4.1 Input quantities of the mathematical model of the problem

α	... angle of view
τ	... pressure angle
z	... number of teeth of the wheel
m	... gear module
b	... tooth width
i	... number of active teeth
j	... number of active tooth gaps
p	... pressure at pump outlet

4.2 Output quantities of the mathematical model of the problem

${}^{P}F_r$	... equivalent workforce radial
${}^{P}F_o$	... equivalent workforce peripheral
M_H	... driving moment
${}^{C}F$	... reaction in tooth contact - general kinematic pair
${}^{A}F_x$, ${}^{A}F_y$	... the reaction components in rotational kinematic pair at point A
${}^{B}F_x$, ${}^{B}F_y$	... the reaction components in rotational kinematic pair at point B

4.3 Analytical solution of the mathematical model

By analyzing the equations (7) … (12), we obtain unknown external and internal action and reaction force effects in the form (15), where the auxiliary parameters $q_1 \ldots q_6$, according the relations (16), and a P_1, P_2, defined by the terms (17), were introduced.

$$ \begin{aligned} M_H &= q_1 + q_4\, r_z, \\ {}^{A}F_x &= q_2 - q_4\cos\alpha, \\ {}^{A}F_y &= q_3 + q_4\sin\alpha, \\ {}^{C}F &= q_4, \\ {}^{B}F_x &= q_5 + q_4\cos\alpha, \\ {}^{B}F_y &= q_6 - q_4\sin\alpha, \end{aligned} \quad (15) $$

where

$$ \begin{aligned} q_1 &= P_2\, r_z, \\ q_2 &= P_1\cos\tau - P_2\sin(\tau-\alpha), \\ q_3 &= P_1\sin\tau + P_2\cos(\tau-\alpha), \\ q_4 &= P_2, \\ q_5 &= P_1\cos\tau - P_2\sin(\tau-\alpha), \\ q_6 &= -P_1\sin\tau - P_2\cos(\tau-\alpha), \end{aligned} \quad (16) $$

where

$$ \begin{aligned} P_1 &= j\,\frac{\pi m}{2}\, b\, p, \\ P_2 &= r\, 2\, m\, b\, p. \end{aligned} \quad (17) $$

5. Mathematical model in matrix form

The mathematical model of the problem is rewritten into matrix form

$$ \mathbf{K}\cdot\mathbf{L} = \mathbf{P}, \quad (18) $$

where

$$\mathbf{L} = \begin{bmatrix} L_1 \\ L_2 \\ L_3 \\ L_4 \\ L_5 \\ L_6 \end{bmatrix} \tag{19}$$

is the vector unknown,

$$\mathbf{P} = \begin{bmatrix} P_1 \cos\tau - P_2 \sin(\tau - \alpha) \\ P_1 \sin\tau + P_2 \cos(\tau - \alpha) \\ P_2 \cdot r_z \\ P_1 \sin\tau - P_2 \sin(\tau - \alpha) \\ -P_1 \sin\tau - P_2 \cos(\tau - \alpha) \\ P_2 \cdot r_z \end{bmatrix} \tag{20}$$

is the vector of the right sides,

$$\mathbf{K} = \begin{bmatrix} 0 & 1 & 0 & \cos\alpha & 0 & 0 \\ 0 & 0 & 1 & -\sin\alpha & 0 & 0 \\ 1 & 0 & 0 & -r_z & 0 & 0 \\ 0 & 0 & 0 & -\cos\alpha & 1 & 0 \\ 0 & 0 & 0 & \sin\alpha & 0 & 1 \\ 0 & 0 & 0 & r_z & 0 & 0 \end{bmatrix} \tag{21}$$

is the system matrix.

The relation of the vector unknown with the force effects sought is given by relation (22).

$$\begin{aligned} &L_1 = M_H,\ L_2 = {}^{A}F_x,\ L_3 = {}^{A}F_y,\ L_4 = {}^{C}F, \\ &L_5 = {}^{B}F_x, \\ &L_6 = {}^{B}F_y,\ P_1 = {}^{P}F_r,\ P_2 = {}^{P}F_o. \end{aligned} \tag{22}$$

6. Numerical verification of the model

6.1 Model testing parameters

$$\begin{aligned} &m = 2\ [mm], \\ &b = 30\ [mm], \\ &j = 2, \\ &i = 2, \\ &\alpha = 30\ °, \\ &\tau = 45\ °, \\ &p = 30\ MPa, \\ &z = 9. \end{aligned} \tag{23}$$

6.2 Results of the analytical solution

Calculation of responses and drive moment of the gear pump

enter values - variables	*insert in basic units*		
description	mark	value	units
number of tooth gaps	j	2	-
number of teeth	i	2	-
module	m	0,002	m
tooth width	b	0,03	m
pressure	p	30 000 000	Pa
angle of view	α	30	°
pressure angle	τ	45	°
radius of pitch circle	r	0,009	m

intermediate count			
description	*mark*	*value*	*units*
equivalent workforce radial	${}^{P}F_r$	5654,9	N
equivalent workforce peripheral	${}^{P}F_o$	7200	N
reaction force in a round A, axis x	${}^{A}F_x$	-4100,3	N
reaction force in a round A, axis y	${}^{A}F_y$	14553,3	N
reaction force in a round B, axis x	${}^{B}F_x$	8370,5	N
reaction force in a round B, axis y	${}^{B}F_y$	-14553,3	N
teething contact ${}^{C}F_{32}={}^{C}F_{23}$	${}^{C}F_{32}={}^{C}F_{23}$	7200	N
radius of the basic circle	r_z	0,00779	m

calculation			
description	*mark*	*value*	*units*
reaction force in a round A	${}^{A}F$	15119,8	N
reaction force in a round B	${}^{B}F$	16788,8	N
moment to axis Z	M_H	112,2	Nm

7. Conclusion

This paper deals with compilation of a mathematical model for solving the basic role of the process of dimensioning parts of the mechanism, i. e. this is determination of external action and driving force effects and internal and external reactions in kinematic bonds of the mechanism. Internal tooth reaction, external reactions in the bearings and drive torque on the input shaft are determined. These force effects are induced by the action force, or its components, determined by the knowledge of working pressure at the outlet of the pump and geometry of the liquid body in the outlet part of the pump. The parts of the mechanism are considered to be perfectly rigid, including the teeth of the sprockets and the sliding parts of the bearings, the fluid being perfectly incompressible. Involving gearing is modeled as an ideal general kinematic pair, bearings as rotational kinematic pairs. Because of the symmetry of the mechanism, the described problem is solved as a planar task. The mathematical model is constructed by means of Vector Mechanics. We release the individual parts of the mechanism by the method of thought cut and replace the removed real bonds by reaction forces. For the vector power fields that are created and from equilibrium conditions, the mathematical model is formulated, the solution of which we obtain the desired action and reaction, internal and external forces acting on the individual parts of the mechanism. The task leads to the solution of the system of linear non-homogeneous algebraic equations. The task is solved analytically in

closed form, in addition, a numerical matrix solution and then a control graphic solution are performed. For both cases of numerical solution, in EXCEL and OCTAVE applications, the software is created and tuned to allow the user to quickly and user-friendly re-deploying the application in the component dimensioning process.

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ON COUPLED TRANSPORT PHENOMENA IN POROUS MEDIA

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Abstract: *In this contribution we deal with a system of nonlinear nonstationary partial differential equations arising in coupled heat-moisture transport phenomena in unsaturated porous media. The model is completed by an appropriate amount of initial and boundary conditions corresponding to the physical reality of the problem. We breafly present the derivation of the model and present an example to illustrate the applicability of the model and its physical relevance.*

Keywords: *coupled transport, differential equation, mathematical modeling*

1. Introduction

Mathematical modeling of coupled transport processes help us to describe many engineering and environmental issues such as seepage modeling through earth-filled dams and below them (see figure 1) modeling of pollution infiltration in soils and subsurface water sources (see figure 2) modeling of concrete spalling during fire or freezing (see figure 3) and many others.

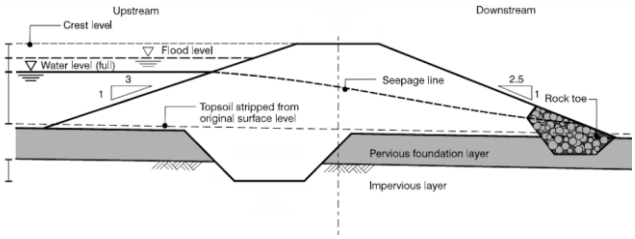

Figure 1: Seepage line through an earth-filled dam

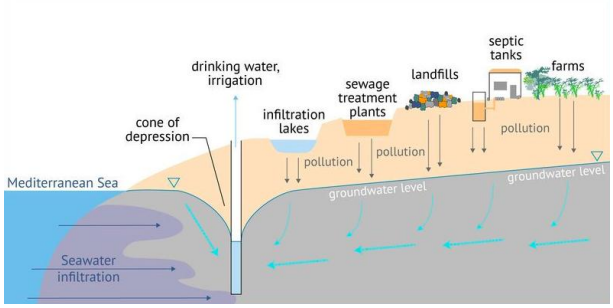

Figure 2: Pollution infiltration through porous media

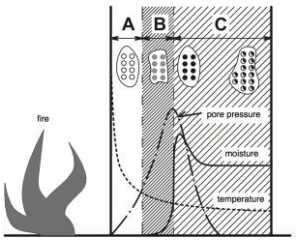

Figure 3: The principle of concrete spalling during fire

In the last years a considerable effort has been invested into analyses of mathematical problems arising from the coupled transport processes in porous media. Most of these papers deal with numerical analysis of the problem, see [5,11]. Qualitative properties of the equations describing the moisture transport are studied in [3,7].

2. Brief derivation of the model

The models describing transport processes are based on conservation equations.

2.1 Mass conservation equation

The change of the mass content of any phase in an arbitrary volume and the mass flow across its boundary is equal to the sources of mass in the volume. In a differential form we can write

$$\frac{\partial(\Theta\rho)}{\partial t} + \nabla \cdot (\Theta\rho\boldsymbol{v}) = f,$$

where Θ [-] is the volume fraction of a phase, ρ [kg m^{-3}] is the phase averaged density, $\boldsymbol{v}$ [ms^{-1}] is the vector of velocity of a phase and f [kg m^{-3} s^{-1}] is the term representing the sources of mass.

2.2 Energy conservation equation

The change of the energy content in an arbitrary volume and the heat flow across its boundary is equal to the sources of heat in the volume. In a differential form we can write

$$c_p \frac{\partial \square}{\partial t} + \nabla \cdot \boldsymbol{q} = Q,$$

where c_p [J m^{-3} K^{-1}] is the specific heat, T [K] is temperature, $\boldsymbol{q}$ [J s^{-3}] is the heat flux generally including conduction, convection and radiation and Q [J m^{-3} s^{-1}] is the term representing sources of heat.

2.3 Basic assumptions

In order to simplify the mathematical model we presume some basic assumptions corresponding to the physical reality:

- the medium consists of liquid water and skeleton;
- the solid phase is not deformable and does not move;
- there are no sources in the medium;
- heat radiation is neglected;
- we deal with unsaturated porous medium (i.e. zones with negative pressure head h_ℓ [m]. See figure 4.).

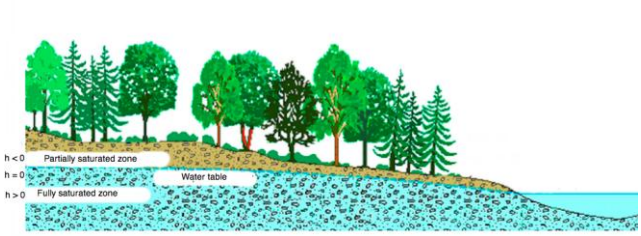

Figure 4: Different saturation zones in porous medium

2.3 Constitutive relations for moisture and heat flux

To complete the mathematical model we need the constitutive relations for moisture flux and heat conduction.

Darcy law for moisture flux:

The water flow is described by the modified Darcy law [1,8,10]

$$\theta_\ell \boldsymbol{v_\ell} = -K_{Lh}\nabla(h_\ell + z) - K_{LT}\nabla T$$

where K_{Lh} [ms^{-1}] denotes isothermal hydraulic conductivity, h_ℓ [m] is the pressure head, z [m] denotes the vertical coordinate and K_{LT} [ms^{-1}] is the thermal hydraulic conductivity. The contribution of the thermal hydraulic conductivity is neglected here due to its physical irrelevance compared to the isothermal conductivity. (see figures 4 and 5)

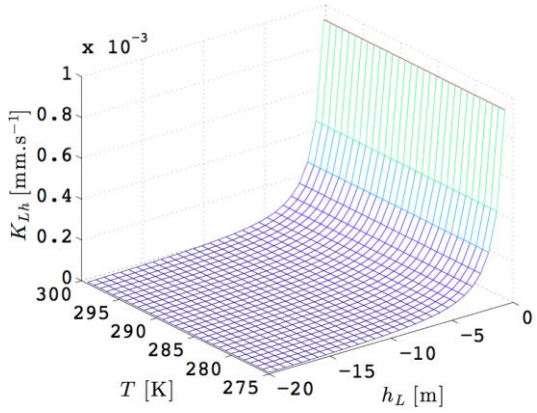

Figure 5: Isothermal hydraulic conductivity of soils

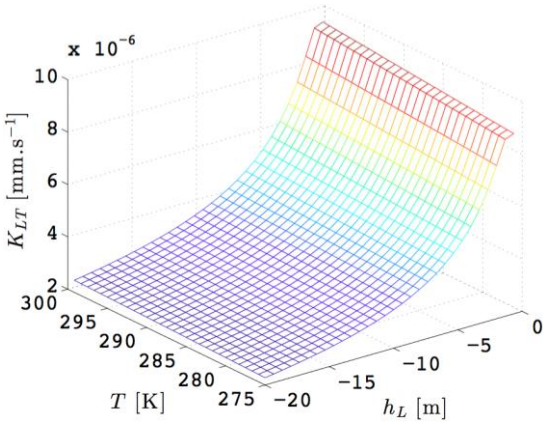

Figure 6: Thermal hydraulic conductivity of soils

The isothermal hydraulic conductivity is given by [9,13]

$$K_{Lh}(h_\ell, T) = K_{\square} K_{\square}(h_\ell) \frac{\nu(25)}{\nu(T)}$$

where K_s [ms^{-1}] is the saturated hydraulic conductivity, $K_{\square}$ [ms^{-1}] is the effective hydraulic conductivity and ν is the cinematic viscosity.

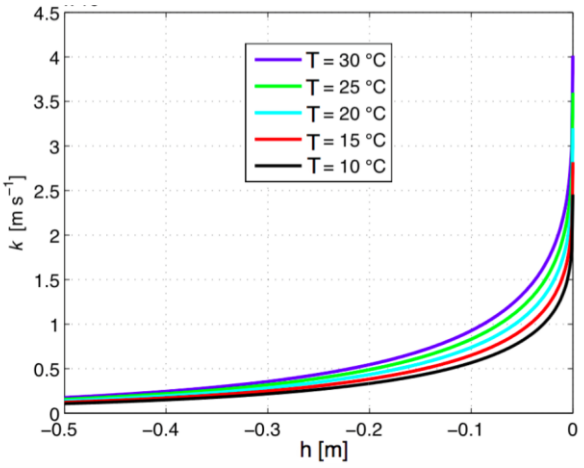

Figure 7: Isothermal hydraulic conductivity of soils

Fourier's law for heat conduction:

The heat conduction is described by the Fourier's law

$$\boldsymbol{q}_{cond} = -\lambda\nabla T$$

where λ [W m^{-1} K^{-1}] is the thermal conductivity.

3. Mathematical model

The complete mathematical model describing coupled moisture and heat transport processes in porous media consists of the following initial boundary value problem (ℓ denotes liquid, $\square$ denotes solid skeleton):

$$\begin{aligned} \frac{\partial\theta(h)}{\partial t} &= \nabla\cdot(k(h,T)\nabla(h+z)) \\ c_\ell\frac{\partial(\theta(h)T)}{\partial t}+c_s\frac{\partial T}{\partial t} &= \nabla\cdot(\lambda(h,T)\nabla\mathrm{T})+\nabla\cdot[Tc_\ell\rho_\ell k(h,T)\nabla(h+z)] \\ h &= h_D \\ T &= T_D \\ -(k\nabla(h+z)\cdot\mathbf{n} &= q_\ell \\ -(\lambda(h,T)\nabla\mathrm{T})\cdot\mathbf{n} &= \alpha_c(T-T_\infty)+q_H \\ h &= h_0 \\ \mathrm{T} &= \mathrm{T}_0 \end{aligned}$$

Here **n** denotes outward unit vector, q_ℓ is prescribed moisture flux across the boundary, q_H is prescribed heat flux across the boundary, α_c is heat transfer coefficient. h_D, T_D are prescribed values of temperature and pressure head and h_0, T_0 are initial conditions for pressure head and temperature.

3. Numerical example

In order to illustrate the applicability of the derived model we present a simple illustrative example. We deal with the one dimensional soil column which is being exposed at the top surface to temperature changes corresponding to temperature changes during day and night.

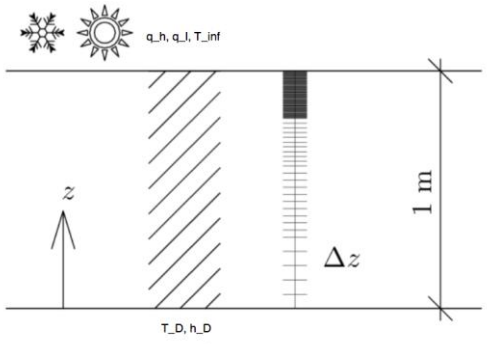

Figure 8: Analysed onedimensional soil column

The boundary and initial conditions for the illustrative example are as follows

Table 1: Boundary and initial conditions

symbol	*description*	*value*	*unit*
T_0	initial temperature	273.15	K
h_0	initial pressure head	-20+z	m
q_ℓ	prescribed moisture flux	0	ms^{-1}
q_H	prescribed heat flux	0	Wm^{-2}
T_∞	ambient outside temp.	see figure 9	K
T_D	prescribed temperature	273.15	K
h_D	prescribed pressure	20	m

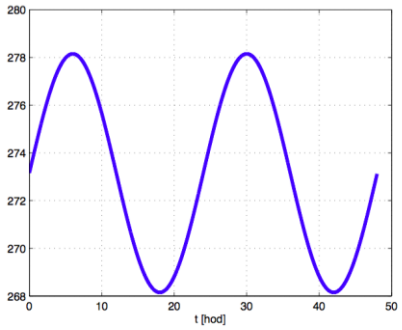

Figure 9: Ambient temperature T_∞ at the top surface

The problem was solved in Matlab using semi-implicit discretization in time which leads to a system of nonlinear stationary equations in each time step which was solved by Newton method. The spacial discretization was carried out by means of the finite element method with linear approximation. The physical properties of soil are taken over from the literature [2,4,6,12,14]. As an example we present the results of temperature field under the soil surface.

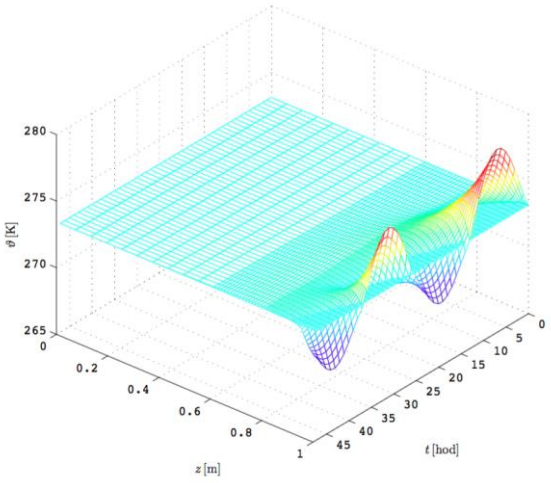

Figure 10: Temperature field in the soil column

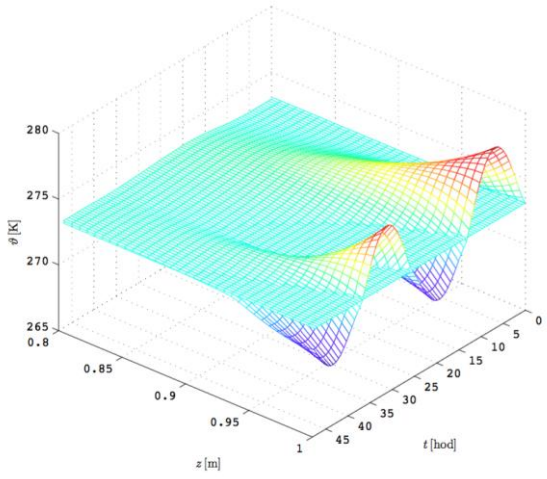

Figure 11: Temperature field right under the surface

6. Conclusions

This contribution deals with mathematical modeling of coupled transport processes in porous media. We suggest a model describing coupled moisture and heat transport (it is also possible to model the pollution transport or any other liquid phase) and we demonstrate its applicability on an illustrative example.

Acknowledgements

This work was supported by the project *SGS18/001/ OHK1/1T/11* provided by the Grant Agency of CTU in Prague.

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THE CROSS SECTION OF SPECIALIZED EDUCATION IN ŽILINA REGION

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Abstract: *The article presents historical development of education in Žilina region, including law regulations, which were valid in certain historical times. The aim is to give information about development educational system in this region, the most important representatives of educators. On the base of analyse of different literary, scientific or magazine pieces of work we are presenting a review of education in this region from the beginning of the first schools. We point at how the education was spreading in different historical times.*

Keywords: *education, education system, Žilina*

1. Introduction

The Žilina district lies on North-west of Slovakia. It´s regions Kysuce and Orava are neighbours with Czech Republic and Poland. It is a specific district with a lot of nature beauty, forests, rivers, river dams, a huge number of cultural monuments. The oldest changed latin name of Žilina is Sylna. The oldest Žilina signet, which seal was made in the first half of 14th Century has a name Sigillum Civium de Zilina and in documents from year 1297 is Žilina mentioned as Zilina [1].

1.1 Beginnings of education

The specialized education from historical view started with the crafts. Already in Žilina town book are mentioned elected Jacobus Carnifex (Jakub Mäsiar) a Jakobus Sútor (Jakub Švec) into town council in year 1391, from what we deduce, that in this time were in the town craftsmen as shoemakers and butchers how the surnames show us [11]. The Žilina region was a important craft centrum on Považie. Every Monday were taking a place weakly markets, where craftsmen were selling their goods. They were millers, butchers, brewers, coopers, tailors, smiths, hatters, knobblers, coopers [12]. The first documented written mention about a school is from a year 1542, when was in Žilina established academy – so called a school of higher level, Evangelic grammar school. From the statements of Žilina book there were rectors of this academy as Jur Bánovský, Mojžiš Bánovský, Eliáš Ladiver sr, Eliáš Ladiver yr, Michal Ascanius-Haško, Samuel Nigrini. The school had a great reputation and high quality thank to well educated teachers. At this school were studied students from whole Hungary and from Abroad, too. Later they were working in Hungary, but abroad, as well [4].

1.2 The development of the school system

The church was a dominant power thank to it started wide development of education in a town. Jesuits established in year 1691 the lower grammar school, based in Jesuit monkery and it had 75 pupils. The Žilina latin school-grammar school was one of the best town school in Slovakia, at that time. It went through a difficult historical develop from a year 1542. In a year 1761 Jesuits , who participated in education in a town, established the first glass of lower grammar school, which was active until the abolish the fraternity in a year 1773. From the anniversary report it is clear, that in the charge of latin school was a rector, who had a duty to supervise the discipline of pupils, ensure the fulfill of their religion duties, creating education bans for teachers, create a time schedule for teachers and teaching theology and philosophy at the highest class. His deputy was a konrector, who was teaching at lower classes. The next teachers was a cantor, who was teaching singing and the theory of music [3]. The spirit of the school system was catholic church. Particular schools included into education system also lowest level of education, what was operating in five class measure. In the lowest class, the first were tough boys 6-9 years old in religion, beginnings of latin language and mother language. After a finishing of two classes, usually ten years old boy went to third class- gramatists, what had almost two parts, where studied whole systematic grammar with the help of so called Cato minor- the first kid's reading book. The education lasted until the 16th year of the life of a student and after that a student could enter to the philosophic or theological class which last for 5 years, after that he could be church professional or working in the offices [5]. The grammar school was given by a King decree on the 1.11. 1776 to Franciscans, who built a new school building. From the year 1789 were established higher classes of speech and poesy. A school was operating until a year 1850. After that year in a building was created a private school. There was no school in a town and that was a reason, why citizens requested grammar school. In 1855 was established lower real school, because of lack of money. The most important teacher was Jozef Božetech Klemens between years 1856-1863, when the school finished it´s existence.

1.3 The development of industry in region

With the develop of industry was higher requirement for production and trade. Representatives of a town Žilina understood that they need to establish a vocational school. In 1856 started Sunday teaching for apprentice, who were

organized in guilds. The attendance and continuance of learning was controlled by guild chairmen until year 1879 when was a learning temporary stopped because guild organization stopped its existence. In 1878 started a construction of a new school with repeated learning process in 1882 thanks to two teachers of Roman-catholic boys school , Móric Kropáči and Vojtech Hainrich. A school existed as Sunday vocational school, learning process was in two classes, on Sunday from ten to twelve o´clock, during two semester, winter and summer semester. The pupils were divided into group preparatory and the first class and independent class drawing school with teaching of technical drawing and channeling. Teaching process was in Slovak language. Thanks to Móric Kropáči, who was an administrator of vocational school and was at a school until 1931 was educational process systematic. From a year 1885/1886 started school teaching also on Thursday afternoon from 2pm-3pm for preparatory class, school had a character of Sunday Church school. In the center of educational process was writing, reading, math, history, civics, drawing, art of lettering. On the base of act of commissar of industrial school was on 1.9.1886 by course of law Nr. 17/1884 [6] established council Industrial vocational school, which started a teaching process on 21.11.1886, because of reconstruction of a building. In 1886/1887 was the school attended by 110 apprentices in first classes. The second class was opened in a year 1888/1889 and the third in a school year 1894/1895. The financial funding of a school was under a responsibility town of Žilina. Teaching and organizational plans were approved by act of ministry of education in a year 1893. The range of teaching process was between 7 and 9 classes per week, which were taking part during evening hours or Sunday afternoon. From a year 1894/1895 was second teaching language Hungarian language and also a state started to fund a school, which was attended also by apprentices out of Žilina. The official name of the school was The Council Industrial-vocational school. Until a year 1918 there was a huge effort to bring Hungarian language into educational process, what had a negative influence to pupil´s achievement, because they didn´t understand a language. In a year 1911/1912 school had 350 pupils. In this year was a town Žilina given a status of city and a school started to use a name The City Industrial-vocational school in Žilina, which was valid until school reform in 1924. In a school year 1920/1921 a school had 367 pupils. In a year 1923 was starting a new develop of vocational school, which asked for a permission to established in Žilina vocational of metalworking, carpentry, tailoring, shoemaking and shop keeping trading continuation school. Their establish was done on base of an act The ministry of education and national educational training on 6.6.1923, when the first classes were opened in a school year 1923/1924, the second classes 1924/1925 and the third 1925/1926 [7]. At the same time was by act from 7.7.1923 permitted to establish in Žilina two class shop keeping continuation school, which is considered as the first school with focusing on education in economics. From the school year 1924/1925 were established also school for shop girls and by sequel was cancelled the evening classes and instead of them came on afternoon classes from 1pm-6pm. According to law 259/1924 was the Industrial-vocational school divided into council school(elementary school) and continuation school for different crafts as of metalworking, wood cutting, carpentry, tailoring, shoemaking and shop keeping. The names of crafts were by the time changed. The numbers of apprentices and shop girls were growing up, and from this reason were established branches and groups on the base of special education. In a school year 1926/1927 [7] were registered 751 pupils. From this reason the city asked for construction of independent building of vocational school. The Ministry of education and national education adopted rules for special continuation schools valid from a year 1928/1929. From 1.9.1936 were vocational schools in Vrútky, varín, Rajec, Kysucké Nové Mesto and Považská Bystrica cancelled. In Žilina was created central vocational school, what was given a name The Specialized district vocational school in 1938/1939 and from a year 1939 until 1947 had a name The Specialized vocational school. During the Second world war the education process stagnated,and teaching process started again on 23.5.1945.

The city of Žilina established in a year 1868 lower four classes grammar school and in 1873 higher six classes grammar school with a name The King´s Catholic grammar school in Žilina. In 1900 was a grammar school reorganized into the higher state real school in Žilina with Hungarian teaching language. This seven years real school, what was a higher type of high school, was preparing pupils for jobs in industry, business, trade, but also was a preparation for studying at universities [3]. Acceptance of pupils into real school was conditional by showing of baptism certificate from the reason to find out the age (10 years), report from the council school (verification of mark from math and learning language), passing an entry test by written an oral form. During the entrance test, pupils had to show knowledge from reading, writing, spelling, arithmetic, they had to know adding, counting off, multiplying, dividing and individually to solve different mathematic problems [10]. From the 1st of September 1936 was the real school named to The State real grammar school with mandatory French teaching language. How was the last type of high school changing, real grammar schools finished their existence and also real school in Žilina changed name to The State grammar school in Žilina [7]. The right to education was enacted in the constitution. From the historical documents, we can see that grammar school and real school in Žilina were only selective schools in Kysuce area, district Žilina and district Považská Bystrica until 1938. These school were visited by more than half of non-residents. The real school was visited by 50,6 %, girls grammar school 51 % and from that 15 % pupils from more than 30 km distance [1].

2. Conclusion

The development of general education schools in Žilina is possible to divide into 4 stages [1]:

1. Stage from the year 1945 until publishing The Law about basic modification of united education in the year 1948.
2. Stage from the year 1948 until publishing the Law about the new school network in the year 1953.
3. Stage of new school network from the year 1953.
4. Stage of realisation of duties from the XI. Congress of KSČ described in document About close joining school with the life and further development of education and pedagogy in Czechoslovak socialist republic (next ČSSR).

The first two point at quality changes in education in city of Žilina, what was the school ath that time well equipped. The new burger´s schools were created in surrounding of Žilina (Trnové, Varín) and from this reason were coming still less pupils from villages around the town. On the base of law acts were cancelled girls and boys schools and were created coeducation national and burger´s (later high) schools. In the third stage according the law from 1953 were created in Žilina area two fully organized 11 years high schools (next JSŠ): I. JSŠ a II. JSŠ, and after that are established another JSŠ in Bytča, Rajec, Varín, and Kysucké Nové Mesto. By the new law from the year 1953 is created united mandatory general education school and in the city started existence of 4 eight years high schools. The stage from the year 1953 [13] is specific by building the schools, their reconstruction, additional building and innovation of buildings. The big help during this process were providing factories, but also parents during the action Z. In this stage was in the city created special school for the kids, which were lower mental abilities and could not visit an ordinary school. Near the hospital was settled a school for blunt-sighted kids, what was one of the first school in Slovakia. After the first specialized school- the high economic school created in a year 1938 accrued in 1958 specialized medical school, from a year 1960 the industrial school of construction and agricultural technical school, into what was in a year 1962 affiliated school agricultural asset.

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[13] Zákon č. 31/1953 zaviedol jedenásťročnú strednú školu, ako organizačne zjednotený typ školy pre vzdelávanie mládeže od šiesteho do sedemnásteho veku.

THE INTERRELATIONSHIP BETWEEN CREATIVITY AND THE CLASSROOM CLIMATE IN THE MIDDLE SCHOOL AGE

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Abstract: *The work is focused on the identification of mutual connections between creativity and the classroom climate in students in middle school age. The aim of the thesis is to find out which aspects of the climate of the school environment are a predictor of creativity. We chose the research population through deliberate selection and consisted of 104 (N = 104) participants aged 10 to 12 years. We used the Torrance Test of Creative Thinking (TTCT) and the My Class Inventory (MCI) questionnaire for the classroom climate. The relation between the creativity of students and the classroom climate assessment proved to be statistically significant only in terms of creativity – originality. We managed to record only one predictor in our research population, and it concerns a variable - disputes in class, which enables to predict the creativity - originality factor in students.*

Keywords: *creativity, classroom climate, middle school age, mutual connections*

1. Introduction

The concept of creativity and its research is related to several areas of psychology [17], which characterize it through different ways and use other methods to measure it, which caused that there is no uniform definition of creativity. A distinctive feature of all definitions of creativity is the focus on clarifying its complexity. Four common aspects of creativity were selected. Creativity is always determined by an individual who must carry out a certain act to create a product of creativity. Creativity is influenced to a great extent by the environment in which it occurs [4]. The definitions of the classroom climate vary, but they match the sources that create it. On the one hand, students with their characteristic features and behavior are the source. Through this, the climate of one class differs from another. Teachers are another source of the climate. Their behavior, characteristics, style of leadership, and leadership of teaching influences the classroom climate [1]. It means that the classroom climate is created by teachers and students in mutual interaction [14].

Many experts [16]; [5]; [7] focus on the favorable and unfavorable classroom climate in connection with creativity. According to P. Gavora [5], the education of creativity, its diagnosing and the overall development of the creative thinking of the individual requires a safe environment. A creative product can only be created in a quiet, unobtrusive climate. The autonomy of each individual is respected and supported in an environment created in this manner [6]. The main feature of the classroom climate supporting student's creativity is the absence of tension and rivalry, as well as mutual cooperation, trust and respect [8]. In her research, M. Jurčová [11] focused on the climate, which according to her clearly affects creativity. Creative students most clearly perceived the support of ideas and trust, which are the climatic characteristics that create social well-being, satisfaction, a sense of security and positive relationships. V. Salbot and L. Pašková [16] also agree with this statement, and they think that the better and favorable the classroom climate is, the better conditions for the growth of a student's creativity emerge. A creative classroom climate is mostly determined by the relationship between teachers and students. A negative classroom climate slows down the development of creative abilities. R. McLellan and B. Nicholl [15] discovered that strict rules in a class, excessive organization of classes by the teachers and the difficulty of the curriculum and the teaching itself may slow down the creativity. The analysis of collected data showed that the students felt overworked, they did not feel the opportunity and freedom during classes, which resulted in a negative perception of classroom climate for their creativity. T. Kováč and R. Keklak [12] found out that the more creative students assessed classroom climate more negatively than the less creative students. M. Hsu and H. Fan [7] states that the creativity and climate of a workplace are determined by a time pressure, which can inhibit creativity and induces the emergence of a negative climate. Jaiswal with Dhar [9] discovered that the support from the surroundings and positive climate influence the creativity. A. Baranovská and V. Kalivodová [2] mention that it is necessary to specify tasks and motivate individuals in order to enhance creativity.

The research of R. McLellan with B. Nicholl [15], Hsu and Fan [7], Hunter [8], O. Dău-Gaspar [3] deal with the connections between creativity and classroom climate and the research of T. Kováč and R. Keklak [12] focuses on how classroom climate can influence creativity. We have formulated our three hypotheses and one research question according to the abovementioned researches:

H1: There is statistically significant connection between the originality and evaluation of classroom climate.
H2: There is no significant relationship between flexibility and evaluation of classroom climate.

H3: There is no statistically significant connection between fluency and evaluation of classroom climate.
RQ1: Which variables of classroom climate act as predictors of students' originality?

2. Methodology

2.1 Research sample

The research sample was obtained according to the deliberate selection, and consisted of students of 5th and 6th grade of two primary schools in Hlohovec and Piešťany district. The research sample consisted of 104 participants aged from 10 to 12 years. Of 104 students (100%), there were 55 boys (53%) and 49 girls (47%). Students are comparable from the viewpoint of school quality, socio-economic status, area and infrastructure of towns.

Tab. 1 Research sample - students

CLASSES	*BOYS*	*GIRLS*	*TOTAL*
5.A	7	14	21
5.B	12	12	24
6.A	13	6	19
6.B	12	7	19
6.C	11	10	21
TOTAL	55	49	104

Source: author of the work

2.2 Materials and equipment

We used two research methods in our research. The first one involves Torrance Test of Creative Thinking, which is standardized for our population [10] and which helped us to discover creativity potential. Through the answers to three subtests, it is possible to measure flexibility, originality, fluency and elaboration.

The second questionnaire called "MY CLASS INVENTORY" is designated for students of 3th to 6th grade of the primary school. The questionnaire contains 25 items, which can be answered to by circling yes/no. The questionnaire helps us to find out about the situation in class from 5 viewpoints: satisfaction in class, disputes in class, competitiveness in class, difficulty of classes, cohesiveness of class [6]. Since it concerns non-standardized questionnaire, we surveyed its internal consistency. The value of Cronbach's alpha reached the value required during the implementation of researches (α=0.872).

Tab. 2 Return of questionnaire "My class inventory"

Cronbach's Alpha[a]	*N of Items*
.872	5

2.3 Procedure

We used specialized statistical computer program Statistical Package for the Social Sciences – SPSS 20, through which we processed the researched data. Referring to the fact that we made comparative-correlative research, we used the following:

- Reliability test to find out normality,
- Pearson's correlation analysis to find out connections,
- Linear regression analysis to find out predictors. The comparison of statistical model with measured data proved that the model is appropriate.

In order to be transparent, we state tables under the individual hypotheses and research question.

H1: There is statistically significant connection between the originality and evaluation of classroom climate.
According to the normal organization of the researched variables within the research sample, we have chosen parametric Pearson correlation coefficient.

Tab. 3 Connection between the originality and individual factors of school climate

	SAT	*DISP*	*COM*	*DIFF.*	*COH*
ORIG r	0.25*	-0.45**	-0.34**	-0.27**	0.22*
p	0.011	0.000	0.001	0.006	0.023

Source: author of the work
r - correlation coefficient
p - significance achieved

Table no. 3 shows that the originality as a factor of creativity is connected with the evaluation of classroom climate (p_{sa}=0,011; p_{di}=0,000; p_{com}=0,001; p_{dif}=0,006; p_{coh}=0,023).Correlation coefficients although indicate only weak relation. In case of satisfaction and cohesiveness in class, we can mention positive relation - the more original a student is, they evaluate classroom climate more satisfactory and more cohesive. In relation to disputes, we can mention medium strong negative relation - the more original a student is, the less argumentative a class seems to them. The more original a student is, the less competitively the class seems to them and also curriculum seems less difficult to them. Based on the results, we accept the hypothesis no. 1, the originality is connected with the evaluation of classroom climate.

H2: There is no significant relationship between flexibility and evaluation of classroom climate.

Tab. 4 Relation between flexibility and individual factors of a school climate

	SAT	*DIS*	*COM*	*DIF*	*COH*
FLEX r	0.03	-0.09	-0.01	-0.03	0.12
p	0.785	0.373	0.933	0.758	0.229

Source: author of the work
r - correlation coefficient
p - significance achieved

Table no. 4 shows that there is no statistically significant relation between flexibility and the individual factors of school climate, since the significance was higher than 0.05. Negative tendency was noted between the relation difficulty — flexibility and competitiveness — flexibility. Based on the results, we accept hypothesis no. 2, flexibility is not related to the evaluation of classroom climate.

H3: There is no statistically significant connection between fluency and evaluation of classroom climate.

Tab. 5 Relation between fluency and school climate

		SAT	*DIS*	*COM*	*DIF*	*COH*
FLU	r	-0.13	0.07	0.05	0.02	-0.04
	p	0.180	0.482	0.580	0.835	0.662

Source: author of the work
r - correlation coefficient
p - significance achieved

Table no. 5 shows that there is no statistically significant relation between fluency and the individual factors of school climate, since the significance was higher than 0.05. Negative tendency was noted between relation satisfaction — fluency, and competitiveness — fluency. Based on the results, we accept hypothesis no.3.

RQ1: Which variables of classroom climate act as predictors of students' originality?

In order to determine the predictors, we used linear regression analysis. It is possible to explain 17.2% of the originality dispersion, a dependent variable, via the model.

Tab. 6 Predictor for the factor of students' originality

PREDICTORS	R SQUARE	B	STANDARD ERROR	BETA	t	P
DISPUTES IN CLASSROOM	0.172	-0.137	0.030	-0.414	-4.598	**0.000**

DW = 2.372
Source: author of the work
B - regression coefficient
P - significance achieved

Table no. 6 shows predictor of classroom climate for the factor of students' originality. Of the all potential predictors - variables of classroom climate, disputes in classroom are the strongest and the most statistically significant for the originality of students (B=-0.137; p=0.000).

4. Discussion

4.1 Interpretation of Results

Regarding the fact that the created classroom climate may indicate the creativity, or on the contrary, to inhibit it, we were finding out whether there is a connection between factors of creativity and classroom climate through the first three hypotheses. Based on our research, we found out that the original students in our research sample evaluated the climate positively, the curriculum was not difficult for them, they considered the classroom less quarrelsome and competitive, which conforms to the findings of R. McLellan and B. Nicholl [15]. In the first hypothesis, we confirmed that the originality is related to the individual factors of school climate, which corresponds with several researches [18]. T. Kováč and R. Keklak [12] ascertained that more original students evaluate classroom climate more negatively in comparison with their less creative classmates. The situation is caused by high influence of conformity from classmates, who do not like to accept creative and different individuals in their group. Such attitude of others may cause in creative students unpleasant feelings of difference, which leads towards the emergence of disputes and negative climate. The situation shows that creative and talented students have problems to create social relations [11]. In several cases, students with higher creativity are too introvert and the research of S. Hunter [8] also confirmed the positive relation between creativity and introversion. It is also interesting that flexibility and fluency are not related to the classroom climate, which complies with the other researches [7]; [1].

Of the all classroom climate variables, only the variable of classroom disputes was confirmed as the strongest predictor for the factor of students' originality. In our case, the predictor belongs into negative characteristics, which means that the more serious disputes are, the lower is the originality. The finding corresponds with the reality, because, the students in classrooms with greater amount of disputes may be afraid to express their originality and original ideas, or they do not have the possibilities to express their creativity as much as they want. Also Allodi [1] consider the open space with low number of disputes one of the numerous pro-creative phenomena. However, in most cases we can find contradictory opinions and findings in scientific literature and researches [12]. By the fact that the original students express their originality in classroom, the other classmates consider them others, as ones diverting from their ideas. The students do not like their creative classmates with original ideas, this is why they often argue with them and cause disputes in the class. It concerns one of barriers in the school area, mentioned also in the first part of our work. We specifically mean conformity with the group, where the creative students are considered abnormal and classmates consider their creativity inappropriate [9]. The fact of the most creative students being least favorite in the class was confirmed also by the research of Dău-Gaspar [3]. According to our findings, we can say that students in conflict and negative environment do not express their original side of creativity, probably in order to fit into the class and avoid being excluded by classmates. In this time, the contact with contemporaries and popularity in class is the most important thing for a student. By this, they calm their need of self-realization and need to belong somewhere. Children in middle school age choose their friends based on the other abilities and experience, which often are not related to the school and obligations, which is also confirmed by M. Vágnerová [19]. They give greater importance to the socially insignificant or undesirable experience like small thefts, first contact with smoking. This leads us to another opinion, that the creative students may have tendency to lower their originality and their original expressions. However, they will express their creativity in positive environment, which was also confirmed by our research.

4.2 Limitations of research

After performing our research, despite our attempt to avoid shortages, we noted several limitations.

We can consider limitation the research methods themselves, used during the collection of data. It concerns self-assessment methods, where students and teaches could knowingly answer to the social questions by desirable answers, which could distort the results of questionnaire about the classroom climate. Distortions could cause limited answers in the questionnaire finding about the classroom climate, since it was possible to choose one of the options (yes/no), students and teachers also might not understand the claims sufficiently. The fact of the Torrance Test of Creative Thinking being a favorite test not only among the psychologists, but also among teachers, is also related to this limitation. This leads to the fact that teachers themselves use the test for their own purposes and students may know about the test. This may lead to the distortion of results being found out by psychological researches, thus it is possible that the phenomenon appeared also in our research.

The current experience of the actors may be another limitation. Before completing research methods, we were not concerned about their health condition, neither whether any serious dispute or difficult exam occurred during the previous lessons, which could influence mostly the questionnaire of evaluation of classroom climate.

A third limitation concerns fear or reluctance of several students to cooperate during completing questionnaires and tests. One group consisted of students, who feared that the results will be presented to teachers and director of the school. We tried to advise students before and during the completion of questionnaires, that the results will serve exclusively for the purposes of diploma thesis and that the whole testing is anonymous. However, it is possible that the anonymity was not sufficiently mentioned from the viewpoint of students, or it may have been disturbed due to our presence in the classroom during completion of questionnaires. Second group of students consisted of students not interested in tests and reluctant to work with them. We tried to communicate with students in a friendly, funny manner, to motivate them to complete questionnaires, which had positive results in some cases. Teachers may have been influenced by their subjective evaluations, which we cannot avoid, unfortunately.

One of the limitations may include the research sample not being balanced. We specifically mean unbalanced representation of boys and girls in total, and also in the individual classes. The number of boys and girls in classrooms is notably present during the evaluation and creation of classroom climate, which may influence creative abilities of students. We can also consider teachers to be unbalanced sample, since women had higher presence than their men colleagues.

4.3 Recommendations for the practice

The findings of our research show, that the created classroom climate is related to the creativity of students and it is necessary to build and maintain mostly the positive climate, which contributes to the overall satisfaction. In our case, we have noted the connection of positive climate with the originality of students. In order to maintain positive classroom climate, it is necessary to solve emerging problems in class "here and now," so they cannot cause the occurrence of tension in the class, to teach students how to solve disputes by a compromise, which leads to mutual respect and tolerance. A teacher shall also create suitable space for discussion about problems and their solutions, not only in relation to homework, but also problems in the class, it may lead to strengthen relations. It is necessary that cohesiveness in a class would grow with a contribution of extracurricular events (trips, excursions), where students and teachers may know each other better.

4.4 Aims for the future

In a future research, it would be interesting to focus also on the personality besides the creativity and classroom climate. We would focus our attention on finding relations and connections between creativity, classroom climate and personal characteristics. Researches prove negative attitude of students towards highly creative classmates due to their difference of personality [7]. This is why we think that we would obtain interesting results by involvement of sociometric method. Since the aim of our research was to examine connections of the individual variables not only in students, we would definitely involve teachers into the research again. It is known that teacher influences their students also by their personality.

In future, we would definitely focus on creation of program of creativity development in school environment. We realize that there are several programs to support creativity, but within the program, we would also focus on enhancing positive classroom climate, thus cooperation and cohesiveness. We could also focus on the implementation of experiment in a class in the future.

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THE LAST SABRE OF POLAND. POLISH SABRE MODEL 1934 - LUDWIKÓWKA

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Abstract: *Polish cavalry is one of the most famous in the history of the world military. Its splendour did not extinguish in the sixteenth and seventeenth centuries. Between the First and Second World War, the cavalry tradition was cultivated in Poland. Then the best sabre of all time was created - the Polish sabre model 1934 also called 'Ludwikówka'. This weapon combined the tradition and the latest trends. The process of its production, selection and use was special. This sabre passed into legend as the last Polish fighting sabre used by Polish soldiers during the Second World War. The legend of this weapon cannot be forgotten. For this reason, it was decided to bring the genesis of its origin, process of execution, quality control and implementation into the army.*

Keywords: *sabre, Polish sabre, Ludwikowka, lancers, cold steel*

Only few objects are so closely connected with the fate of Poland like a sabre [1, pp. 133–141]. The sabre was mainly intended for cavalry and was used to slice, rarely to push [2, pp. 11–18]. The cause of its spread in the country of the Vistula River should be sought in close relationships with the East and the common threat of mobile Asian hordes. Under such circumstances, the necessity of adopting in the Polish Army some tactical solutions enabled the repulsion of light cavalry formation. Very important was also the Hungarian influence in Poland at the turn of the thirteenth and fourteenth century and the impact of the oriental culture [3, pp. 6, 30–32].

1. Introduction

The cultural and military importance of sabre in Poland is significant. Therefore, this weapon became both a symbol of Polishness, steadfastness and military excellence of Poles. Even in the interwar period (between the 1st and 2nd World War), when the cold steel left the history cards, the sabre was a symbol of Polish heroism. Unfortunately, in the September 1939 campaign, it also proved to be a symbol of Polish military backwardness and defeat. Undoubtedly, the most remarkable variant of the sabre, created based on the experience of generations, was a sabre model 1934 also called from the place of its production (Ludwików Steelworks) - *Ludwikówka*. This weapon, although excellent in its construction, execution and material, used by the most outstanding cavalry, could not oppose the German and Russian enemies. However, it is a symbol of the end of power of the Polish army and the end of side warfare arms. Unquestionably, *Ludwikówka* became the last battle sabre of Rzeczpospolita.

Ludwikówka's subject is known in Polish historiography. However, recent studies appeared almost half a century ago and have not taken into account the socio-cultural background of its creation and use. In the period of socialism, symbols of Rzeczpospolita's power could be described only as valuable technique, not as signs of national independence and power. In this manner, prominent authors, now extensively cited, characterized the sabre. Fortunately, for a few years there has been a social movement intended to find, describe and promote symbols of Polish military technology, including sabres. Unfortunately, these activities are mostly amateurish, although very valuable [4]. However, the importance of Polish weaponry is little known in countries outside of Poland, although it enjoys increasing interest among enthusiasts. We try to briefly characterize *Ludwikówka* sabre in historical, cultural and social contexts for these reasons. We also carry out its assessment, both as a tool of combat, as well as symbolic significance.

2. The oldest Polish sabres

The oldest Polish sabres are copies used in infantry units on the second half of the 15th century [5, p. 185]. However, the wider use of this weapon is observed in the reign of king Stefan Batory. At that time, a number of eastern weapons, known as the chechug or Armenian karabela, appeared in Poland. At the end of the 17th century, the type of Polish sabre was developed from these forms of eastern sabres. The great development of cold steel is observed later: there is famous *Zygmuntówka* (1st part of 17th century) - from the name of king Zygmunt Vasa, *Janówka* - from Jan III Sobieski (2nd part of 17th century), *Augustówka* or at the end – *Kościuszkówka* (the end of 18th century).

A separate type of sabre developed collaterally to karabela, was the hussar sabre (the first copies from 1630). These arms had a slightly curved firebrand, a single bail hilt, a straight crossguards with an unchained back arm and a long barb that ran parallel along the firebrand. The complete novum in the design was a toe greatly facilitating the operation of the sabre [5, p. 272], [6, p. 35]. Hussar sabre combines the possibilities of the best construction forms of eastern and western European sabres (toes) [7]. A new sword was created to improve the combat of the horse [8, pp. 57–93], [9]. Its design system placed it in the rank of the best cavalry sabre in the world. This resulted in the

use of the combat until the end of the eighteenth century. Designers of the Polish twentieth century sabres modelled it on the hussar sabre. Both types of sabres became symbols of the Polish nobleman in the nineteenth century, when the Polish lands were under the domination of Austria, Prussia and Russia [10].

3. Sabre in the interwar period

When Poland gained independence in 1918, about 50,000 sabres remained in the armaments of the newly formed army, which were used earlier by the cavalry of the invading armies [2, p. 151], [11, p. 70]. The first sabre, made only for Polish soldiers, was a sabre ordered by the Austrians in 1917. The first copies were made at the Zieleniewski Factory in Cracow [2, p. 172].

Sabre, along with various types of French, English, Prussian, Austrian, Russian and Cossack sabres, entered Polish Army as a statutory weapon and were the first exact Polish cavalry equipment after 1918 [2, p. 151], [12]. The great difficulties of the newly formed army, with the unification of armaments, caused that at the end of 1919, officers of the 1st Lancer Regiment (1 Pułk Ułanów Krechowieckich) were privately commissioned to design a new model of the sabre modelled on hussars - *Krechowiecki* sabre. This weapon mainly made in Germany is considered to be the prototype of the 1921 model sabre [13]. Undoubtedly, the new type of sabre was the highest quality as was produced by outstanding German companies, like Carl Eickhorn of Solingen and many excellent Polish companies, such as Alfons Mann Factory, Jarnuszkiewicz Factory, ARMA from L'viv, G. Borowski Factory and Motor Factory Perkun (notabene being the most prominent engine factory in Poland) [14], [15, pp. 24–34].

Probably the most widespread sabre in Polish Army in the interwar period, was the model 1921 (modification - 1922), which was the refinement of the 1917 sabre. Its final version looked as follows:

*[...] light firebrand, length 80 cm, width at the base 3.4 cm, slightly tapering to 2.5 cm, with one groove [...] (*or triple groove - note by author*), cross-yoke handle with smooth yoke extending upward [...], wooden handle binding, [...], weight of sabre about 0.9 kilograms* [16, p. 245]

It was produced in G. Borowski and A. Mann factories. Unfortunately, the sabre had a negative opinion of the users who paid attention to the poor quality of the steel it was made of.

4. Ludwikówka

4.1 Competition

In 1925, due to imperfection, lack of standardization and lack of numbers in the military sabres, work on a new model of side arms for cavalry was undertaken.w. Subsequently, sabres model 1921/22 were eliminated from cavalry units. In 1925, the *General Inspectorate of the Armed Forces* (Generalny Inspektorat Sił Zbrojnych) commissioned *the Armament and Equipment Committee* (Komitet do Spraw Uzbrojenia i Sprzętu) to develop a new sabre model. The head of the work was experienced cavalry colonel Zbigniew Brochowicz-Lewiński [17, pp. 121–122], [18].

A competition to develop a new model of sabre was announced. The sabre was supposed to be designed as a cavalry sabre and its overall weight with the scabbard should not exceed 1.6 kilograms. It should have the proper balance for its functionality and be prepared for chopping and stabbing. The firebrand and the hilt should be of adequate strength, the hilt with a yoke at right angles should fasten with the yoke at right angles, which was to fasten with the crossguards. Cladding of the hilt should be non-metallic and the metal parts of the hilt - the upper arm, the crossguards and any rivets, should be retracted into the handle so as not to transfer the cold on the hand of the horseman. Additionally, the metal parts of the sabre had to be made of stainless steel and the matching of the sabre to the scabbard was to be accurate enough to eliminate the rattling of the weapon [8, p. 57].

In the competition, taking place on September 16, 1931, seven teams represented by eminent theorists and armaments practitioners attended. Competition requirements were very strict. Therefore, not all original projects were accepted. However, the jury proposed to select four best projects and make 30 test pieces. After sabres manufacturing at the Perkun factory in Warsaw, the sabres were assigned to 6 selected cavalry regiments for testing [2, p. 199]. Drawing on the conclusions of the trial reports in 1934, work on the second prototype of the sabre began. In 1935, General Adolf Waraksiewicz and Colonel Tomasz Dobrzański - eminent Polish fencers, recommended one of these projects for the Polish Army. In the spring of this year, 150 new experimental sabres were made. The competition commission, led by General Boleslaw Wieniawa-Długoszowski, finally accepted the draft of the sabre in the autumn of 1935.

4.2 Technical specifications

The model 1934 of sabre was characterized by excellent technical and tactical qualities, surpassing the quality of the cavalry sabres of other European countries. Mainly, it was manufactured from the spring steel from the Baildon Steelworks in Katowice (branch of the Ludwików factory). According to the procurement based on the results of the tender, each sabre had to meet strict requirements [4]:

Length 82.5 centimetres, width at the base 3.4 cm, the ridge thickness at the base 0.8 cm, and at by curvature 3 cm. Blades were sanded on both sides with grooves on the back. The blade ended with a double-edged feather, 21 cm long, with a spear on both sides. The hilt had to have a handle made of beech wood with goffering; linings made of seasoned wood and impregnated with linseed. The wood grains on the linings were laid at an angle of 15 degrees relative to the mandrel. To be fixed with two steel bolts

with brass nuts and brass reinforcement ring at the base. Brass crossguards 13 cm in length, in the ringe part end with a hole for the sling, and in the slicing part curved at right angles to the hilt, forming a yoke coupled to the mandrel of the hilt. Each of the crossguards attached by one nut to the mandrel of the hilt. Length of the handle 10, 5-cm. Leather pad mounted on the hilt base. At the yokes leather sling. Single-ribbed oxidized steel scabbard consisting of a ring with a cell and a movable spike with a spur. Inset pressed into the scabbard pallium. The total weight of the sabre with the scabbard was 1.46 kilograms and the weight of the sabre was 0.91 [13, p. 76].

Institute of Technical Arms (Instytut Techniczny Uzbrojenia) was developed to the sabre the appropriate model of the sling and the instructions for strapping to the saddle in accordance with the recommendations of the *Centre for Cavalry Training* (Centrum Wyszkolenia Kawalerii) [19, p. 163].

August 26, 1935, the Minister of Defence approved the sabre model 1934 as mandatory in the Polish Army. A trial series of sabres were sent for testing in cavalry regiments. As a result of this research, a new model of sabre was adopted in the army resulting inits introduction into mass production based on the order of *the Head of the Armaments Department* (Departament Uzbrojenia) of February 22, 1936, which states:

Because of the positive results of tests carried out with the sabres in cavalry units, I allowed Ludwików factory to launch mass-production of the sabre model 1934. The head of the Arms Institute of the Armed Forces, in preparation of technical conditions will, as far as possible, take into account the objections of the Head of Cavalry Department [2, p. 200].

4.3 Ludwików Factory

The question is why the production of the sabre was commissioned to Ludwików steel factory in Kielce. Probably the answer can be found in the fact that in Poland in the 1920s there were no factories capable of producing this type of military equipment. Therefore, the Ministry of Military Affairs undertook building new factories, which could work for the needs of the army. Their location in the *Safety Triangle* (Trójkąt Bezpieczeństwa, Centralny Okręg Przemysłowy), which also included Kielce, was understandable [14, pp. 145–148], [20]. The case also facilitated government's takeover of the Silesian steel concern, *Huta Pokój*, which was a producer of high quality spring steel essential in cold steel manufacture [14, pp. 89–91], [21]. The company, alongside number of other factories, entered Huta Ludwików in Kielce [22, pp. 45, 58].

In February 1936, the Ludwików Factory received an order from the army. It consisted of 11,500 sabres (the order was increased to 16,000). The next batch was sent to production on January 11, 1937 (an additional 14,470 units). Finally, on July 1, 1938, the Polish Army possessed 39 564 sabres model 1934, of which 27 605 were equipped with troops. Therefore, when needs were lower, the difference was used to arm the other branches. Cavalry units received it for the entire state of mobilization in the rules provided. Therefore, the units mobilized by backup centres in September 1939, were generally armed with the sabres 1934 model [23, pp. 109–128].

4.4 Quality control

In Ludwików Factory existed internal sabres quality control procedures. However, quality control was so rigorous that it provided not only quality assurance but also sabre sharpening rules and the choice of preservative vaseline types. Under special control was also sabres-made material. The first step was checking the steel. The L'viv Polytechnic studied steel for the production of armaments, manufactured in Baildon Steelworks in Katowice. Next, already in Kielce, number of control activities were carried out during the production process a, which traces preserved on the sabres. There are traces of small dots on the mandrel, which were developed by Rockwell's state-of-the-art hardness tester. After the internal inspection, the sabre model 1934 was subjected to rigorous military acceptance by the appraisers. The name of the expert was etched on the ridge of the sabre firebrand and the heel of the scabbard [24]. It was the final reception, which ended the production process of the sabre as a set: sabre plus scabbard [25, p. 230].

Successful completion of the receiving operations qualified the sabre for use in the army. In order to qualify sabre for the military, it had to meet number of conditions:

- pierce the 2-mm thick metal sheet by the firebrand dropping from the height of 2 meters without damaging the blade
- cutting the 5-mm steel rod 5 times on the lead pad without damaging the blade
- pass the impact test of the ridge and blade in the teres trunk of the hard wood to check the attachment of the firebrand to the hilt
- pass the bending test, where the blade based on the wood and subjected to manual pressure several times and cannot be reversed on both sides
- the scabbard flats on two washers (at the neck and the spur), with a load of 120 kg, could not show deformation or cracks
- the force required to draw the sabre from the scabbard had to be between 5 and 10 kg [25, p. 234]

The cost of producing the sabre was 25 zł of the Ludwików factory's own costs. The sales military price was 38 zł [25, p. 236]. In addition to the battle sabres, several richly decorated gift items were also made. One of such sabres was given to: Romanian king Michal I, head of the Armaments Department, general Mieczysław Maciejowski, and Chief Executive Officer of the Ludwików Factory Otmar Kwiecinski [11, p. 82].

The 1934 model of sabre was a weapon designed for all troops and ranks in the Polish army. Towards the end of the 1930s, it was planned to extend the model 1934 to other types of weapons and services, particularly for cavalry officers (sabre 1938 model). But the forthcoming war distracted the attention of *the Armaments Department* (Departament Uzbrojenia) from issues related to armaments in side arms [2, p. 204].

5. Conclusions

Why in the twentieth-century European army was so interested in the production of already obsolete armament, which was a cavalry sabre. The defensive doctrine of the newly founded state was based on the experience of the First World War and the Polish-Soviet War of 1920. Therefore, it was envisaged that the main areas of possible fights would be extensive plains in the east of the country, where Polish troops could meet with large Red Army cavalry armed with cold steel. Beating the Soviet inroads off would be effective only through cavalry. However, the Polish cavalry in the years 1918-1939 was not large. At the beginning of World War II, it accounted for less than 10% of the Polish armed forces.

According to the defence doctrine, the role of cavalry was only to support the infantry, while horses served mainly as a transport. Its use did not provide for a charge on the tanks. Cavalry tasks included: recognition, cover of mobilization, rapid and violent strikes on the wings of the enemy, retreat to the rear to cut back roads, defence and insurance of the wings of the own army, insurance of secondary sections of the front and pursuit battles [26].

The cavalry was organized into a brigade system that were human teams of 8 to 9 thousand soldiers. Such system excluded the commissioning of independent cavalry operations. The military regulations clearly stated that the cavalry maneuverers on horseback, struggles on foot and only under exceptional circumstances charges [27], [28]. In such conditions, cavalry could not be effective in fighting on the western front in 1939. Hence, its refinement, the production of new types of sabres should be regarded as anachronism already in the thirties.

Unfortunately, the Polish headquarters followed the experience of earlier great cavalry wars too closely, instead of thinking of new forms of warfare. Polish officers were too attached to the former Polish cavalry tradition [29], [30]. This approach led to the rapid defeat of September. However, it cannot be overlooked that the model 1934 sabre has undoubtedly become the heroine of the last famous cavalry charge in battles under Mokra, Krojanty or Kalushyn [31]. Regrettably, it was also a symbol of German propaganda, showing Polish desperate charges for tanks [32].

While evaluating these side arms in isolation from its use it should be emphasized that *Ludwikówka* was the quintessence of the sabre. It was an effective, handy, yet elegant and relatively inexpensive weapon. The sabre of 1934 combined all the best experience of the world cold steels. It was a symbol of the last chivalry chord of the Polish cavalry power, but a symbol of perfection. It is a pity that it began to symbolize defeat, became a symbol of propaganda. It is horrible that for nearly 50 years of the socialist period in Poland, it was not narrated the "capitalist" history of this weapon. Luckily, in the 21st century, the sabre model 1934 was spotted by passionate people and it is beginning to symbolize the power of the Polish army. Metaphor of the most beautiful values and history of Poland.

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OVERVIEW OF DIVORCE, ABORTION AND PARENTAL LEAVE LEGISLATION IN SLOVAKIA BETWEEN 1946-2016 AND ITS IMPACT ON DIVORCE, ABORTION AND BIRTH RATES

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***Abstract**: Legislation is one of the factors that shape the life of the society, including family. Among the non-economic laws that determine the family as the basic unit of society with its social reproductive function are laws that address divorce policy, abortion policy and parental leave policy. Analysis of the most significant legislation changes in said areas throughout seventy years of Slovak history 1946-2016 shows that, although the law can be traced to have some tangible impact, it is neither exclusive, nor the most significant determinant of divorce, abortion and birth rates.*

***Keywords**: family law, divorce, abortion, parental leave, birth rate*

1. Introduction

Legislation is an important element in the life of society. It usually sets the duties and boundaries for the civic conduct and thus shapes the behaviour of the inhabitants. Family law is no exception. This paper illustrates if and how the legal measures taken in the sphere of divorce, abortion and parental leave in Slovakia over the seventy-year period 1946-2016 influence the course of divorce, abortion and birth rates. The data have been taken from The Statistical Office of Slovak Republic [1].

2. Divorce legislation

Before 1949, the Slovak law system operated under legal dualism: officially the marriage and divorce law were codified for whole Czechoslovakia by General civic code No. 320/1919 [2], also called the "Separation Act", but in practice Slovak courts operated under legal system coming from Hungarian monarchy [3]. However, the two systems were not very different when speaking about the separation of marriage. Slovak legal system and practice recognized dissolution of marriage due to 1) ultimate reasons and 2) relative reasons. When applied for dissolution due to the ultimate reasons, it was always granted (ultimate reasons were: adultery, fornication against the nature, abandonment, physical offense, prison sentence for at least five years). The relative reasons (serious breach of marriage duties, immoral life of the spouse, etc.) led to investigation of the gravity of the relationship breakdown and resulted in marriage dissolution only in cases when the continuation of marriage proved to be unbearable. Usually, in such cases the court firstly ordered separation from table and bed - to provide a chance for reconciliation - and if it did not occur within half to one year, the marriage was dissolved [4].

After the World War II. Slovakia and Czechia were again reunited and in 1948 Czechoslovakia was taken over by the Communist regime for next forty years. One of the first significant laws adopted was Family Act No. 265/1949, effective from January 1, 1950. It introduced modern conception of divorce as we know it today [5]. The separation from table and bed – the first step of the two-step order of the divorce – was abandoned and divorce remained the only term the law recognized [6]. The divorce trials thus became significantly easier and simpler, although the applicants had to meet various conditions to obtain the approval of the court. For example, the court would not grant the divorce, if it were against the interest of the underage children [7].

The Communists aimed at adoption of modern, progressive approach towards divorces in the light of Communist ideology proclaiming equality between men and women; yet, on the other hand, they despised divorce as the failure of the Communist citizen to fulfil the duty towards society and failure of the Communist ideas as such. Therefore, the legislation and courts were not really in favour of divorces [8]. Since 1953, by order of the Conclusion of the plenary session of the Highest Court No. 2/53, the courts were even bound to try to reconciliate the spouses during the first hearing [9].

Legal measure No. 61/1955 [10] adopted by National Assembly made divorces even more easier, as in certain cases it allowed divorce proposed by the culpable party, without consent of the innocent party, under the condition that the parties did not live together for a long time. That was not possible under the previous law. The measure entered into effect January 1, 1956.

New Family Act No. 94/1963 [11] (effective since April 1, 1964) abandoned the culpability approach in divorce matters and introduced the so called objective criterion, considering ability of the marriage to fulfil its social function. If the decay of marriage was so grave that it was not able to fulfil its social function, the marriage could be divorced. Yet again, the court had to consider the best interest of underage children. It might be worth noting that this Act described motherhood as the most honourable vocation of a woman and stated that "Volatile approach to marriage conflicts with the interest of society. Therefore, it is possible to accede to abolishment of the marriage by divorce only in socially justified cases [12]."

New procedural condition in civic law code No. 99/1963 [13], effective April 1, 1964, introduced obligatory

reconciliation procedure of the spouses. Amendment No. 49/1973 [14] (effective July 1, 1973) cancelled this procedural condition and substituted it with the obligation of the court to guide spouses to eliminate the reasons of the marriage breakdown and to their reconciliation. Both these measures meant impediment to the ease of divorces and thus strengthening of the institution of marriage.

The 1963 Family Act remained effective in Slovakia also after the fall of Communism in 1989 and division of Czechoslovakia into Czech and Slovak republics in 1993 [6]. It took twelve years for independent Slovakia to adopt new Family Act No. 36/2005 [15], which entered into effect April 1, 2005 and is still valid today. The Act allows divorce only in justified instances but in reality, it has become considerably easy to get divorced [16]. The official basis for divorce is grave disruption and permanent breakdown of spouses' relationship which cannot be expected to renew and which impairs the function of the marriage. The court must investigate the reasons that led to this state and like previous Family Acts, takes into consideration the interest of underage children. Divorce by mutual agreement without investigating the reasons is still not an option.

2.1 Development of divorce rate in respect to legislation changes

The simplification of divorces in 1950 marks the rapid increase of the divorces, almost triple the value of 1949, although only double the value of 1948. In 1953, when the courts started trying to reconciliate the spouses during the first hearing, we see the decrease which extends to following year. With simplification of divorces 1956 we see their small increase and the New Family Act of 1964 marks the start of their rapid growth. It is likely that it was influenced by adoption of the new approach of objective criterion in divorce matters. Even the obligatory reconciliation procedure established that same year and duty of the courts to try to reconciliate the spouses since 1973 were not able to stop the steep and continuous divorce growth. The 2005 Act seems to go in line with the trend, leading to the peak in 2006 when the number of divorces reached the historical maximum 12 716. Since then the number of divorces decreases without any significant legal measure taken.

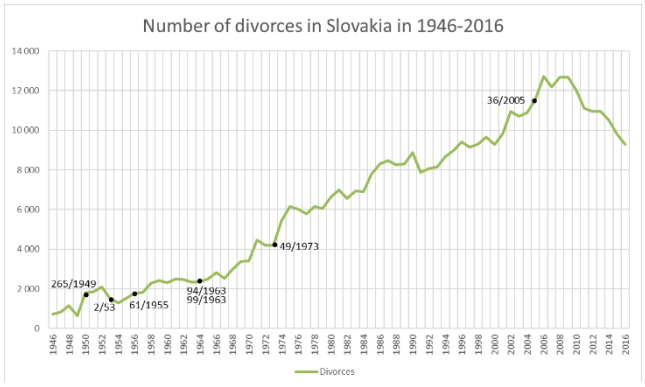

Figure 1: Number of divorces in Slovakia in 1946-2016 with marked laws

3. Abortion legislation

Before 1948 the abortion in Slovakia was completely prohibited by Act No. 66/1941 [17]. (By the term *abortion* we mean *induced abortion* throughout the whole article.) Few months later the exception in situations threatening the life of a woman was advocated and *de facto* permitted by the letter of Slovak Ministry of Justice to the Slovak Physicians' Guild [18]. Whether and to what extent this instruction was followed is unclear, although there is a reasonable assumption that it was widely accepted [19]. The exception in the situations threatening the life of a woman was firstly legalized in 1950 by the Criminal Act No. 86/1950 [20] (effective August 1, 1950), stating that abortion was not a criminal offense in two cases: 1) when continuation of pregnancy or delivery itself was a serious threat to the life of the mother, or 2) when one of the parents suffered a serious hereditary disease. Otherwise it remained a criminal offense. The significant liberalization of abortions came in 1957 with the Interruption Act No. 68/1957 [21] (effective December 19, 1957). The reasons for abortion were listed in §3, article 2 as "health reasons, as well as other reasons worth special consideration." The abortions had to be officially approved by special commission and performed in a hospital. Illegal abortion and any assistance to it remained a criminal offense, which was grounded already in the §218 of the Criminal Act No. 86/1950; yet, the §8, article 2 of the 1957 Act declared impunity of a woman undergoing it. Among the reasons for abortion worth special consideration were: higher age of a woman (forty or more), at least three living children, difficult situation of a single mother, housing or financial crisis, etc [22]. However, the abortion could not be performed even when these conditions were met, if specific health issues or prescribed distance between two abortions prevented it. Also, abortion could be performed only within first three months. Since 1982, due to the Notice of Ministry of Health No. 141/1982 it was possible to preform abortion in certain other cases, e.g. after the failure of intrauterine contraception, even when the time between two abortions was shorter than twelve months.

The most significant liberalization of abortion legislation was adopted in 1986. The Abortion Act No. 73/1986 [23] and subsequent Notice of Health Ministry No. 74/1986 [24] both came into effect January 1, 1987 and are still valid to this day. They have allowed abortion on demand and abortion due to health reasons in official hospitals within the first twelve weeks of pregnancy, if there are no health contraindications. If the life of a woman is under threat, or if the baby is seriously damaged or not viable, abortion is permitted anytime during pregnancy. The Act also imposed a duty on a physician to instruct a woman about possible health consequences of the abortion and about the use of contraceptives. Later, the Act No. 576/2004 [25] (effective January 1, 2005) introduced a so called "anonymous birth" which provided a woman anonymity, if she asked for it. The vague obligation to instruct a woman about the abortion of the 1986 Act was refined in 2009 by Amendment to the 2004 Act No. 345/2009 [26], effective September 1, 2009. It imposed the

obligation on the physician to instruct all women asking for abortion about wide range of abortion aspects, including its nature, proceedings, consequences, physical and mental risks, current developmental stage of the baby and alternative solutions such as anonymous birth and adoption. After the instruction, if a woman still wants to proceed, she is obliged to sign informed consent with the abortion. The abortion itself can be performed at least forty-eight hours passing from the signature of the informed consent.

3.1 Development of abortion rate in respect to legislation changes

The data about abortions till 1957 are not available at The Statistical office of Slovak Republic; therefore, we will analyse only the period 1958-2016. As mentioned earlier, the significant liberalization of abortions came in 1957 and that is reflected by steep increase of abortions. At the beginning of seventies, we see a decrease without any significant legal intervention, so there might had been some other socio-economic factors at work. The measure of 1982 provided a little higher liberalization of abortions, but the curve kept its slow increase as in previous years. The further liberalization of the 1986 Act rocketed the abortions which is reflected on the curve. The abortion rate in 1987, when the Act entered into effect rose by 22.3% compared to previous year. The historical peak was reached next year, in 1988, with 51 000 abortions. Since then we see a rather steep decrease of abortions. The 2004 Act does not seem to have any significant impact on the rate. Its 2009 Amendment may have some impact, as after a bit of a stagnation in 2007-2009 we see further decrease in following years up to this day.

Figure 2: Number of abortions in Slovakia in 1958-2016 with marked laws

Note: The data for 1946-1957 are not available at The Statistical office of Slovak Republic

4. Parental leave legislation

The third factor we will consider is the duration of parental leave. For better clarity it is important to distinguish between *maternity leave* – which is a leave only for mother before and after the birth, and *parental leave* – which is a leave that either of the parents can take (man or woman) to deepen the care and relationship with the child. Whereas maternal leave has been present in our region in various forms since the end of 19th century [27], parental leave is a more current phenomenon.

The first appearance of parental leave in our legal system occurred in 1964 with Act No. 58/1964 [28] (effective April 1, 1964) when the mothers were given opportunity to take parental leave up to one year of the age of the child. Since January 1, 1970 this option was doubled – a mother could stay at home until the baby reached two years [29] and since January 1, 1989 it was tripled – until the baby reached three years [30]. The three-year option is still valid today [31].

4.1 Development of birth-rate in respect to legislation changes

Before establishment of the parental leave, the birth-rate had a slow decreasing tendency (we are working with total births, both live and stillbirths). Surprisingly, after the first introduction of the parental leave in 1964 the birth-rate continued to descent until 1968. The doubling of parental leave in 1970 seems to have an impact on the birth-rate, as from then we see a steep growth till 1979, when the rate began to descend again. The tripling of the leave does not seem to have any significant effect. The rate kept descending and reached the lowest point 51 035 in 2002. Since then the curve has a growing tendency.

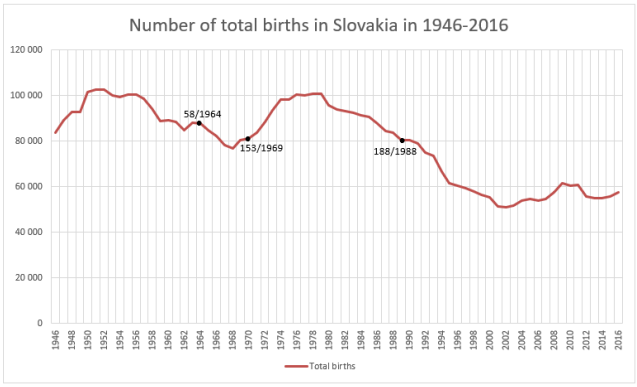

Figure 3: Number of total births in Slovakia in 1946-2016 with marked laws

2. Final overview

The *Figure 4* below provides overview of all three rates for better visualisation of their parallel development over the monitored time.

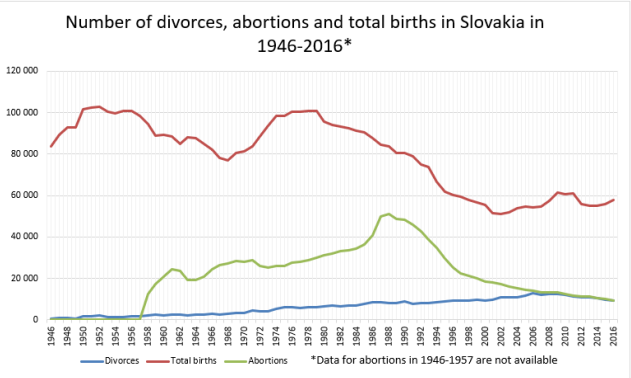

Figure 4: Overview of the number of divorces, abortions and total births in Slovakia in 1946-2016

Note: The data for abortions in 1946-1957 are not available at The Statistical office of Slovak Republic

3. Conclusion

A few impacts of family law on the chosen demographic phenomena can be seen over the seventy-year period 1946-2016 in Slovakia. Especially divorce and abortion rates seem to react to legislation changes noticeably, with divorce rate being enhanced mostly by the Acts 94/1963, 49/1973 and 36/2005; and abortion rate being enhanced by the Acts 68/1957, 141/1982 and 73/1986. However, the curves of all three indicators display considerable oscillation regardless of the legislation changes. These findings show that the law has some impact on divorce, abortion and birth rates, but deeper understanding of the development of the rates would require analysis of the wide spectrum of socio-economic factors.

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THE IMPACT OF THE CUBAN MISSILE CRISIS ON THE INTERNATIONAL LEGAL ORDER

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Abstract: *Over 50 years after the event, the Cuban Missile Crisis of October 1962 continues to puzzle and cause a deep fascination. The crisis brought the world to the brink of nuclear destruction and could undeniably have meant the extermination of millions of human lives if nuclear weapons had been used. For this reason, this confrontation between the United States and the USSR remains one of the most carefully studied events of all the Cold War crises, especially in relation to the consequences it has brought to international legal order.*

Keywords: *Cuban Missile Crisis, international legal order, (defensive) quarantine, nuclear threat*

1. The Cold War as the background of the Cuban Missile Crisis

The term Cold War is often described as the years following World War II. According to Chomsky, the period can be defined in terms of "a conflict between two superpowers" in which the USSR was the aggressor and the United States the world's protector against the Soviets. [1] On the side of the Soviets, the events of the Cold War included recurring interventions in the Eastern part of Europe. Interventions by the United States and its allies spread all over the world. [2] Between the East side and the West side there also existed a great competition for influence in the Third World and struggle over the leadership in the arms race as both superpowers developed nuclear weapons capable of mass destruction. [3] Americans also objected to the Soviets as it was believed they wanted Communism to be the dominant global ideology. [4]

All of these factors constituted the background of the Cold War period, a period of many tensions and mutual suspicions of hostile intentions between military and political alliances that affected relations between the USSR and the United States. [5] Some scholars claim that the period of the Cold War can be considered a time of "a tacit agreement" between the two countries under which they justified their own violence and repressions – the United States in its wars against the Third World and the USSR authoritarian regime in its own domains. [6]

In the time preceding the Cuban Missile Crisis, the battlefield for both superpowers was Europe, more precisely Germany. At that time, the country was divided into East Germany and West Germany, with West Germany controlled by the Americans and British. [7] In 1961, in an effort to stop Germans from leaving Communist controlled East Germany, the Soviet leader Khrushchev ordered the building of the Berlin wall. This action did not serve Khrushchev well. He was broadly criticized on the international scene. The world saw the Wall as an "odious monument to Communist inhumanity" in the words of German chancellor Helmut Kohl. [8] Both sides began concentrating enormous military forces in the region.

However, Europe soon stopped being the focal point of the Cold War. The Third World became the major arena for the competition between the USSR and the United States. [9] The means to winning the competition for geopolitical influence were commercial agreements and military treaties. As noticed by Erlich and Kinzer in their book "Dateline Havana: The Real Story of US Policy and the Future of Cuba", the USSR leader led armed attacks and tended to overlook matters such as human rights violations or corruption, while pursuing the goals which for him were of higher priority. [10] The same, however, can be said about the American leader. President Eisenhower used the Central Intelligence Agency to overthrow unfriendly governments and wanted to make an example of Cuba. [11]

After overthrowing the pro-US Batista regime in 1951, Castro decided to introduce agrarian reform but also expropriated American assets. The leader conducted the nationalization of large, US-owned companies. [12] The United States opposed the idea and thus relations with Cuba deteriorated. Americans stopped buying Cuban's sugar and stopped supplying Cuba with oil. [13] Overthrowing the Castro regime became most crucial for the CIA. Cautious of this endangerment, the Cuban leader decided to tighten his relationship with communist Russia to receive the political support necessary to introduce changes in his country. The CIA trained and armed a group of Cuban emigrants that were supposed to give rise to a revolution against Castro's regime, but the attempt was unsuccessful and it bore serious consequences.

This threat to the USSR's ally encouraged Khrushchev to place nuclear missiles in Cuba. [14] The action led to a tense confrontation between the USSR and the United States. The crisis of 1962 lasted from October 14 till November 20, but the first 13 days of the crisis were the most tense. Many scholars regard this moment as the moment in history when the Cold War was the closest to becoming nuclear war.

2. Chronology of major events of the Cuban Missile Crisis[1]

- October 14 – a U2 plane reveals Soviet missile sites near San Cristobal.
- October 16 – President Kennedy is informed about the offensive missiles. He assemblies the first meeting of ExComm.[2]
- October 17 – a U2 flight discovers more missiles in Cuba.
- October 18 - President Kennedy meets the Soviet Foreign Minister – Andrie Gromyko at the White House. Gromyko denies the Soviets had placed the missiles on the island.
- October 19 – Kennedy continues his campaign as scheduled.
- October 20 – ExComm members are divided – part of them advise a blockade of Cuba, part of them taking a stronger action.
- October 22 – Kennedy informs the nation of his decision to introduce a quarantine of Cuba.
- October 23 – The Organization of American States approves the US decision to quarantine Cuba.
- October 24 (morning) – All the ships on their way toward Cuba either stop or change their way.
- October 24 (afternoon) – The Soviet ships approach the US blockade line. The alert level of Strategic Air Command (SAC) is raised to the highest level.
- October 26 – American navy stops and searches a Lebanese merchant ship Marcula.
- October 26 – President Kennedy receives a letter from the Soviet leader in which he promises to remove the nuclear missiles in exchange for a promise by the US leader that Cuba will not be invaded.
- October 27 – A message from the Soviet leader arrives. Again he promises to remove the missiles in exchange for the assurance that the United States will not invade Cuba and remove Jupiter missiles from Turkey.
- October 27 – An American U-2 mistakenly flies into Soviet airspace. American fighters escort it back to the United States.
- October 27 (noon) – An American U-2 is shot down over the Cuba territory during his attempt to get updated pictures of the missiles.
- October 27 (7:45 p.m.) – Robert Kennedy meets Dobrynin. The men discuss the issue of Jupiter missiles and Cuba.
- October 28 (morning) – Radio Moscow announces that the Soviet missiles will be removed from the territory of Cuba in exchange for Kennedy's promise not to invade the country.

The compromise reached was seen as an embarrassment to the USSR and its leader. Khrushchev appeared unable to cope with the situation that he had himself created. Castro accused the Soviets of "offering up Cuban sovereignty to the US" in exchange for a no-invasion pledge from Kennedy and an agreement on Turkish missiles. [17] Others were also not satisfied with the outcome of the crisis. Some powerful politicians thought that the United States should have undertaken more decisive steps and favored invasion as the most desirable solution to the current situation. [18] They seemed, however, not to consider the possible results to all mankind of a decision to use nuclear weapons.

3. The implications of the Cuban Missile Crisis on international legal order

The Cuban Missile Crisis has exerted an influence on international legal order. Dealing with the crisis required the American decision-makers to assert new rules of international law, as those currently existing ones did not provide clear solutions or direction in a situation like that of 1962. Many scholars believe that the rules which were developed as a result of the conflict were adequate to the situation and in accord with already existing principles of law. [19]

US reconnaissance confirmed the deployment of short-range missiles in Cuba. President Kennedy needed a legal basis on which the United States could take action as a matter of international law. The immediate use of force would be considered an act of aggression and thus its legality could be undermined. A state may, however, use force as an act of self-defense, yet the action ought to be proportional to the threat posed by an aggressor and comply with the rules of international law.

During the first days of the crises, the ExComm members were considering almost all possible options that might lead the USSR to remove the missiles. These were as follows:[3]

- "visit-and-search" blockade
- a broader strike on the three bases plus the Strategic Air Missile sites
- broader strikes plus a blockade on Soviet ships carrying cargo to Cuba
- diplomatic consultation
- invasion
- diplomatic consultation

Secretary of State Dean Rusk was stressed that the United States ought to be seen as a strong and powerful country that would face any threat which it was exposed to. If the country was seen as not giving proper attention to the threat, the USSR would be free to interfere in other parts of Latin America. It might also negatively affect crucial American foreign interests and alliances. [21]

The Excomm members initially favored an air strike, although there were some minor differences in whether an air strike should be broad or limited. President Kennedy

[1] Chronology of major events of the Cuban Missile Crisis is taken after Mark L. Haas [15] and Paul J. Byrne [16].

[2] ExComm (The Executive Committee of the National Security Council) was a group of experts who advised President Kennedy during the Cuban Missile Crisis.

[3] The options are taken after Shirley V. Scott and Radhika Withana [20].

saw, however, a broad air strike as the more hazardous option, thus a limited air strike was preferred. [22]

An invasion was also taken into consideration. This option, however, had more obvious drawbacks. It risked transformation to a general war and most probably would directly lead to the deaths of many people, while the reception of the US allies might be that the action was too harsh and aggressive to meet the threat. [23]

A blockade, although considered as one of the best options, had some obvious shortcomings. Imposing a blockade could only stop more missiles from coming to Cuba, but it would not make the Soviet Union remove those already deployed. [24] Moreover, international law interprets a blockade as an act of war. [25]

On October 20, 1962 Leonard Meeker, Deputy Legal Adviser to the State Department, used the term "defensive quarantine" during the ExComm meeting. He believed that unlike a blockade, the defensive quarantine was acceptable under the Rio Treaty of the OAS, Article 6 and Article 8. [26] As the United States wanted to be seen using the minimum force against the USSR, President Kennedy began to favor quarantine as the best possible option.

While announcing the quarantine to the nation, President Kennedy referred to the two Articles of the Rio Treaty as legal justification for further actions. He asked for broader understanding as the deployment of offensive missiles was regarded as a definite threat to peace and security, not only to Americans but also to millions of people in the world. [27] Recognizing Articles 6[4] [28] and 8[5] [29] of the Rio Treaty as applicable to the situation, the council of Organization of American States voted 19-0. [30] From that moment on, all undertakings, including the use of force to prevent Cuba from receiving further missiles from the Soviets was asserted as legal. However, the legality of imposing a quarantine on all cargo ships heading for Cuba has been the subject of critique, especially over the justification of the measures undertaken grounded in Article 6 of the Rio Treaty. It can be contrasted with Article 51 of the UN Charter which states that action in self-defense is only possible if an armed attack occurs.

[4] Article 6 of Inter-American Treaty of Reciprocal Assistance (Rio Treaty): If the inviolability or the integrity of the territory or the sovereignty or political independence of any American State should be affected by an aggression which is not an armed attack or by an extra-continental or intra-continental conflict, or by any other fact or situation might endanger the peace of America, the Organ of Consultation shall meet immediately in order to agree on the measures which must be taken in case of aggression to assist the victim of the aggression or, in any case, the measures which should be taken for the common defense and for the maintenance of the peace and security of the Continent.

[5] Article 8 of Inter-American Treaty of Reciprocal Assistance (Rio Treaty): For the purposes of this Treaty, the measures on which the Organ of Consultation may agree will comprise one or more of the following: recall of chiefs of diplomatic missions; breaking of diplomatic relations; breaking of consular relations; partial or complete interruption of economic relations or of rail, sea, air, postal, telegraphic, telephonic, and radiotelephonic or radiotelegraphic communications; and use of armed force.

The quarantine was tested for the first time on October 26. Americans conducted an inspection on the ship Marucla, but no missiles were found. The ship carried various other cargo and was allowed to sail to Cuba, but the United States had demonstrated their determination in enforcing the quarantine. [31]

The same evening a letter from Khrushchev arrived. The Soviet Union reported their willingness to dismantle and remove missiles from Cuba and to turn back all the ships carrying nuclear weapons to the USSR. The United States had to make a pledge that they would not invade Cuba. [32] The next day another letter from Khrushchev arrived, but this one was not as conciliatory as the previous one. The Soviet leader demanded the US leader remove American missiles from Turkey in exchange for removing the Soviet missiles from Cuba. [33]

President Kennedy replied to the first letter and agreed not to invade Cuba in exchange for the promise to remove the missiles from Cuba, but along with the group of ExComm members he decided that no formal reply would be given to the second letter of the Soviet leader. Nonetheless the matter of the missiles in Turkey was not overlooked. In fact, Robert Kennedy was authorized to tell the Soviet Ambassador to the US, Dobrynin, that the missiles in Turkey would be removed on condition that the agreement be kept secret and that the public would be told it happened for reasons other than the crisis. [34]

On Sunday, October 28, Khrushchev sent a message announcing that the USSR accepted the conditions issued by the United States and would remove all nuclear missiles from Cuban territory. [35]

4. Conclusions

The history of the United States gives examples of several international policy crises. The Cuban Missile Crisis of 1962 was an event of great importance because it posed a threat to American national security.

An examination of the historical evidence proves that President Kennedy and his advisors were more eager to take any less hazardous action for which some legal justification could be found. Although there are criticisms of the justification of the measures that were undertaken by the Americans, yet the introduction of a defensive quarantine was necessary to fill the gaps which at that time existed in provisions of international law.

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Published in March, 2018 by Sciemcee Publishing, London.
Proceedings document published in collaboration with SCIEMCEE - Scientific Conference Platform.
The proceedings with all papers are available at www.sciemcee.org.

ISBN 978-0-9935191-7-8